

RE
96
S&3

Storage

CORNELL UNIVERSITY.

THE

Roswell P. Flower Library

THE GIFT OF

ROSWELL P. FLOWER

FOR THE USE OF

THE N. Y. STATE VETERINARY COLLEGE.

1897

CORNELL UNIVERSITY LIBRARY



3 1924 104 224 765

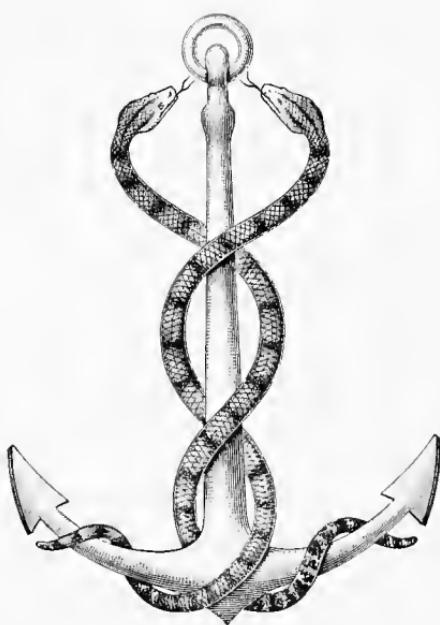


Cornell University Library

The original of this book is in
the Cornell University Library.

There are no known copyright restrictions in
the United States on the use of the text.

EPIDEMIC OPHTHALMIA.



NUNQUAM ALIUD NATURA, ALIUD SAPIENTIA DICIT.

No. 678

ROSWELL P. FLOWE
LIBRARY
N.Y. STATE VET.

EPIDEMIC OPHTHALMIA

*ITS SYMPTOMS, DIAGNOSIS, AND
MANAGEMENT,*
WITH PAPERS UPON ALLIED SUBJECTS.

BY

SYDNEY STEPHENSON, M.B., F.R.C.S.ED.,
SURGEON TO THE OPHTHALMIC SCHOOL, HANWELL, W.

EDINBURGH & LONDON:

YOUNG J. PENTLAND,

1895.

6

P R E F A C E.

THERE is reason for believing that Epidemic Ophthalmia—in some of its bearings at any rate—is not generally understood. Yet, as involving wide economic and social interests, it is, apart from its purely scientific aspect, a subject of no little importance. The malady has worked havoc in many of our parochial institutions, and thousands of pounds have from time to time been expended in order to stay its ravages and to stamp it out of existence. But, for all that, this preventible disease has not hitherto been prevented. Then there is the fact (lately much insisted upon) that our better class schools are not exempt from its attacks. Lastly, the ordinary text-books contain but scant reference to the disorder, so that medical officers have to glean their information from a wide and toilsome field of literature. Under these circumstances, small apology is needed for bringing under the notice of the medical profession a series of essays dealing with various sides of this important question.

For several years past I have been thrown into intimate and extensive relationship with Ophthalmia. It is my aim in the present volume to furnish those interested in the subject with a plain statement of my observations and conclusions. In dealing with the many debatable points

touched upon in these pages, I have endeavoured to place before readers what I believe to be the facts of the case.

It was my original intention to contrast the various forms of Folliculosis and Trachoma by the aid of coloured plates. I found, however, that it was practically impossible to present in that way a satisfactory picture of those conditions. The idea was consequently abandoned.

The pathological aspects of Ophthalmia have been alluded to only in so far as deemed necessary to render my remarks intelligible to the ordinary professional reader. This is due to the fact that at some future date I purpose publishing a separate contribution dealing with that branch of the subject.

For permission to examine the schools mentioned in this book, I have to tender my best thanks to the following among other gentlemen:—Rev. C. E. Gausson, Dr. H. Pitts, Dr. Judson, Canon Leigh, Hon. and Rev. Canon Bridgman, Sir Joseph Fayerer, Rev. R. H. Hadden, Dr. Richard Wormell, Rev. Dr. Tupholme, Rev. Dr. Jackson, Rev. A. W. Wickham, Rev. George Packer, Rev. Bennet Forster, Rev. John Stephenson, Rev. F. Bishop, Mr. Simeon Snell, Mr. T. H. Bickerton, Mr. R. W. Doyne, Mr. J. Hodgson Wright, Mr. Alderman Heape, Mr. R. B. Sellers, Dr. H. Peck, Dr. Benjafield, Dr. Heath, and to the Rev. the Headmasters of Epsom College, St. Edward's, Oxford, and of St. John's, Leatherhead.

SYDNEY STEPHENSON.

33, WELBECK STREET,
LONDON, *October 1895.*

CONTENTS.

EPIDEMIC OPHTHALMIA: ITS SYMPTOMS, DIAGNOSIS, AND MANAGEMENT.

	PAGE
Introduction—Muco-Purulent Ophthalmia—Purulent Ophthalmia—Diphtheritic Ophthalmia—Acute Trachoma—Diagnosis—Chronic Trachoma—Folliculosis—Graefe's Theory—Arlt's Theory—Aerial Infection—Direct Contagion—Indirect Contagion—Washing Utensils—Hands and Fingers—Bed Linen and Body Apparel—Flies—Miscellaneous Agents—The Management of Outbreaks—Epidemics at Chelsea, Anerley, &c.—Methods of securing Isolation—Education of those with Ophthalmia—Dismissal of Ophthalmic Patients—Examining the Eyes of New-comers—Pudendal Discharges and Ophthalmia—Ventilation and Heating—Lavatory Arrangements—Medical Inspections—Conditions common among Children—Measles and Ophthalmia,	1-80

A CLINICAL ENQUIRY INTO THE PREVALENCE AND SIGNIFICANCE OF THE FOLLICULAR GRANULATION OF THE CONJUNCTIVA.

Van Roosbroeck on Ophthalmia—Welch upon Follicular Granulation—Nettleship's Views—Van Millingen upon Granulations—Raehlmann and Mandelstamm's Views—Mutermilch's Theory—Norwood Experiences—Fallacies of Investigation—Importance of precise Terminology—Classification adopted—Method of Examination—General Table—Tables—Does it constitute Early Trachoma?—Connection with Environment—Provisional Conclusions—Slight and Marked Granulations—Associated Conditions—Evidence of Adenoid Activity—Conclusions,	81-125
--	--------

THE TREATMENT OF TRACHOMA AND OF ITS
COMPLICATIONS.

	PAGE
Introductory Sketch—Excision of the cul-de-sac—Expression—Escharotic Treatment—Accessory Measures of Treatment—Summary—THE COMPLICATIONS OF TRACHOMA AND THEIR TREATMENT—Pannus and Ulcers of the Cornea—Dermatitis—Abscess—Blepharitis—Photophobia—Ptosis—Affections of the Tear Passages—Inflammation of the Iris—Trichiasis and Entropion—Ectropion—Symblepharon Posterius,	126-236

THE TREATMENT OF FOLLICULAR CONJUNCTIVITIS.

Treatment of Follicular Conjunctivitis,	237-243
---	---------

APPENDIX.

LAVATORY ARRANGEMENTS.

Washing and Bathing—The Management of Accessories,	244-259
INDEX,	261-267
INDEX OF AUTHORS,	268-271
LITERATURE,	272-278

LIST OF ILLUSTRATIONS.

The micro-organisms found in the different forms of Epidemic Ophthalmia,	<i>Frontispiece</i>
<hr/>	
FIG.	PAGE
1. } Method of excising the upper cul-de-sac,	150, 151
2. }	
3. Graddy's expression forceps,	157
4. Knapp's expression forceps, as modified by author,	158
5. Cotton wool holder,	167
6. Epilation forceps,	224
7. Excision of lashes,	225
8. } Jaesche-Arlt operation for trichiasis,	226, 227
9. }	
10. Van Millingen's operation,	228
11. } Spencer Watson's operation,	230, 231
12. }	
13. "Brooch-pin tourniquet,"	232
14. Green's operation,	233
15. Canthoplasty,	234
16. Galvano-cautery,	242
17. Lavatory at the Central London District School,	245
18. Jets with slate screens,	247
19. Earthenware tubs for bathing the younger children,	250
20. }	
21. } Plans of the "sprinkle baths" at the Leavesden Schools,	252
22. }	
23. Spray bath at the Ophthalmic School,	254
24. Sprays fixed to bath-room at the Strand School,	256
25. Plan of suspending towels,	258

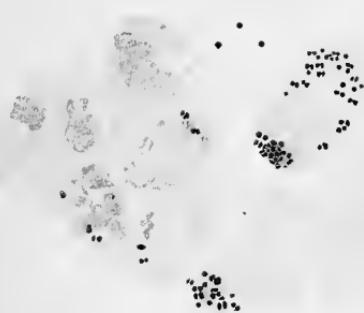


Fig. 1

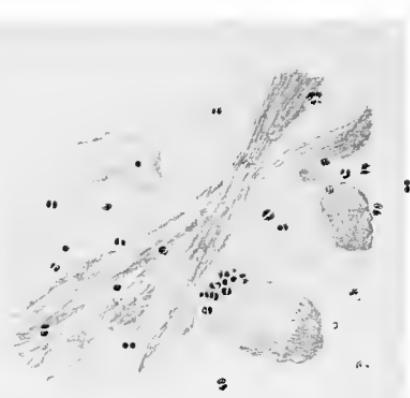


Fig. 2

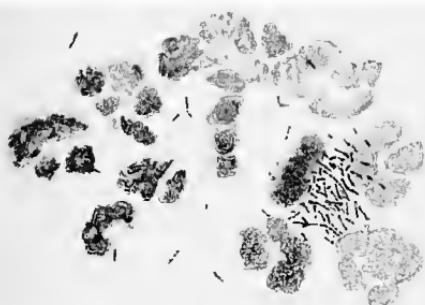


Fig. 3



Fig. 4



Fig. 5



Fig. 6

EXPLANATION OF PLATE.

MERISMOPEDIA GONORRHŒÆ ("gonococcus.")

Fig. 1.—Discharge from right eye in a case of purulent ophthalmia in a little girl (J. E.) Gonococci numerous in cells.

Fig. 2.—Vaginal discharge from same case as in Fig. 1.

Note.—A distinct difference in the size of the gonococci in these preparations may be noted.

Fig. 3.—Bacillus in acute catarrhal ophthalmia. Direct preparation of right eye discharge. (Case C. S.)

Fig. 4.—Culture on 1% agar-agar peptone glycerine broth of the bacillus in catarrhal ophthalmia. (Case C. S.)

Fig. 5.—An organism (diplococcus 0·6—1·0 μ diam.) which may be found in many cases of chronic Trachoma. (Culture on blood-serum.) (Case F. V.)

Fig. 6.—Bacillus diphtheriticus (Klebs-Loeffler). From a culture some weeks old on Loeffler's blood serum mixture, at 37° C.

COVER-GLASS PREPARATIONS.—Stained with methylene blue. Centres of microscopic fields $\frac{1}{2}$ th. Oil immersion lens, Ocular 4, Tube 160 m.m. = 935d.

EPIDEMIC OPHTHALMIA.

EPIDEMIC OPHTHALMIA: ITS SYMPTOMS, DIAGNOSIS, AND MANAGEMENT.

As well known, ophthalmia flourishes in places where people are brought together in large groups. Thus, it invades schools, orphanages, ships, penitentiaries, workhouses, hospitals, prisons, and barracks, where it gives rise to endless trouble, annoyance, and expense.

Although epidemic ophthalmia was known to the ancients, yet it failed to attract serious scientific attention until the earlier part of the present century. At the latter period the disease prevailed in the English and French armies, which had lately been engaged in the Egyptian campaigns. It attacked our own troops with great severity, and on their return home, quickly spread to the civil population. It was sown broadcast among the inhabitants of towns and villages in which soldiers were billeted, and in some cases a whole family was infected through housing a discharged soldier. The malady next invaded the large schools—such as, for example, the Royal Military Asylum and Christ's Hospital, and before long ophthalmia assumed the dimensions of a national calamity.

The subject of “Egyptian ophthalmia,”* as it was then termed, attracted a widespread interest, both on the part of the press and of the public. A host of books, monographs, and papers, written

* A few authors still maintain that epidemic ophthalmia and trachoma were unknown in this country before the return of our troops from Egypt. The fallacious character of such a statement, however, may be shown by a glance at the earlier literature, which will be found epitomised in the following places:—*Ann. d'ocul.*, Bruxelles, 1859, p. 219 (J. Sichel); *ibid.*, tome xli, p. 233 (Vlemincks); Arlt's “Clinical Studies of the Diseases of the Eye,” translated by Ware, p. 55-57; “Description de l'ophthalmie Purulente observée de 1835 à 1839 dans l'hôpital militaire le Saint-Pétersbourg,” par Pierre Florio: Paris, 1841.

chiefly by army surgeons, poured forth from the publishers. The disease became widely recognised among the profession as one of the most formidable maladies known to medical science. As a result of all this agitation, stringent measures were taken—at any rate as regards the army—to stamp out the mischief.

It would be beside the present purpose to trace the onward progress of ophthalmia in these islands, or to tell of the different steps that have been taken to free the army from the pest. It may, however, be stated in general terms that the amount of the disease has been materially lessened, and that modern epidemics are, as a rule, far milder in type than those of sixty or seventy years ago.

There are two reasons why so much has been heard of epidemic ophthalmia during the last half-century. In the first place, the press, keenly alive to the value of sensational matter, rarely neglects an opportunity of drawing attention to the subject. So that now-a-days every newspaper reader is familiar with the headline, "Ophthalmia in a Pauper School," and also with the kind of report that usually follows such an announcement. Secondly, numerous schools have sprung into existence, many of them built and conducted in defiance of the elementary laws of hygiene. Dormitories and classrooms, for instance, are overcrowded and badly ventilated, and there is often a common use of washing utensils. In many cases no provision is made for isolation, which, it need hardly be remarked, is a first necessity in the preventive treatment of ophthalmia. Moreover, some schools make no attempt whatever to stay the admission of diseased children from outside, the gravity of which statement is apparent when we reflect that a single case of ophthalmia may become the starting point of a widespread outbreak. In a word, these imperfectly arranged schools form hotbeds for the growth and spread of this and of other contagious maladies.

Latter day epidemics of ophthalmia vary much in severity. They range from a simple inflammation, entailing no further damage, to a severe condition that may speedily terminate in loss of sight. They differ, moreover, not only in their immediate, but also in their remote results. Some of them, for example, are unattended by

sequelæ, while others give rise to chronic ailments that may burden their owners literally for a lifetime.

Apart from injury to sight, school ophthalmia is the cause of much indirect trouble and loss. As a rule, it brings the education of those affected to a standstill, and the internal administration of a school is, for the time being, utterly disorganised. Then, again, its continued existence or recurrence is beginning to be recognised as an unfailing proof of bad management. In this way the reputation of a public school may be seriously endangered or even altogether destroyed.

In parochial schools enormous sums of money have been spent in the endeavour to get rid of the disease. At Hanwell, for instance, upwards of £30,000 was expended in the erection of a suitable building for isolation, and at least £13,000 has been disbursed in bringing the main school into something like touch with modern sanitary requirements. The direct and indirect expenses of recent outbreaks at Norwood, at Forest Gate, at Sutton, at Edmonton, at Leavesden, at Leytonstone, and at Brentwood, must have been proportionately heavy. It is plain, therefore, that the question of the treatment of ophthalmia involves wide economic interests.

Then, there is the further important fact that a number of children leave our parochial schools carrying with them the germs of disease in a still active condition. These infected individuals constitute a standing menace to all around them. Sooner or later, they come as patients to the ophthalmic hospitals, when they are not infrequently found to have sustained damage to sight. In this way their wage-earning value is reduced, and their chances of a relapse into pauperism are infinitely multiplied. Looking at these things we may say, without hesitation, that guardians who permit ophthalmia to exist in parochial schools are simply manufacturing ratepayers' burdens out of children who, under proper conditions, should become self-supporting and productive members of the community. To put the matter in another way, the money that should have been spent in preventing ophthalmia is paid many times over in supporting the victims of an evaded responsibility.

On the whole, strange though it may seem, ophthalmia has been the indirect cause of numerous improvements in pauper schools. Thus, its prevalence has drawn attention to faults of construction, of organisation, and of administration, many of which have been remedied. It has led to a system of probation, and also to the provision of field playgrounds, and of systematic indoor and outdoor recreation.

In the course of the following pages, an account will be given (*a*) of the various affections grouped under the common name "epidemic ophthalmia," and how to distinguish between them; (*b*) of the ways in which those affections are spread; (*c*) of the measures that have been found most successful in dealing with those several conditions.

When brought face to face with an epidemic eye malady, the surgeon's first duty will be to distinguish clearly between the different affections that may be met with. In extensive outbreaks, it is true, he will not infrequently find a mixture of mild and severe cases, along with others of a more or less anomalous character. With a little care, however, he will be able to classify them into one or other of the following acute diseases, all of which are included under the title "epidemic ophthalmia":—

1. Muco-purulent or Catarrhal Ophthalmia.
2. Purulent Ophthalmia.
3. Diphtheritic Ophthalmia.
4. Acute Trachoma.

In high-class schools, epidemic ophthalmia nearly always belongs to the muco-purulent or catarrhal type of disease. In those of a lower social standing (*e.g.*, the parochial), acute trachoma is more common, although the milder catarrhal affection is by no means rare. At the present time, epidemics of purulent ophthalmia are somewhat infrequent in this country. The complaint, however, may be introduced into a school from without, and may then spread like wildfire among the pupils. Although outbreaks of diphtheritic conjunctivitis have not, so far as I am aware, been observed in England, yet Graefe,¹ Jacobson,² Magnus,⁹⁰ Lewinski,³ and Adler,⁸² have described them in Germany. As the malady may make its appearance at some future time in our large schools, its chief features will receive passing mention.

Let us next glance in succession at the salient points of these different affections.

MUCO-PURULENT or CATARRHAL OPHTHALMIA is the commonest of all the conjunctival inflammations. It is most frequent in spring and autumn, and appears to result, at any rate in sporadic cases, from atmospheric influences, the exact nature of which is still unknown. When once started, however, it spreads by contagion—that is to say, by the transfer of specific secretion from diseased to healthy eyes. It is, indeed, the most infectious eye malady with which we are acquainted.

In the majority of instances catarrhal ophthalmia is by no means a serious affection, and gets well in a period varying from three days to as many weeks. Its symptoms are as follows. The patient may complain of some lacrymation and photophobia and of a sensation which he likens to sand in the eye, although, as a rule, subjective sensations are not well marked. The upper lid is sometimes slightly glossy and oedematous at its free edge ; the eye is bloodshot. The palpebral conjunctiva is reddened and more or less swollen, but its surface generally remains smooth. The bulbar conjunctiva, which is traversed by few or many enlarged vessels, often shows small plum-coloured spots or patches, due to haemorrhage, and at times may be somewhat swollen and oedematous. The character of the secretion varies according to the stage of the ailment. At first, it is watery and contains flakes of mucus, while later it becomes muco-purulent. In a case of ordinary severity, a yellowish-white discharge cakes about the lashes and collects at the inner canthus, or lies free in the sinuses of the conjunctiva. If the secretion be profuse, the skin of the eyelids may get excoriated, so that eczema may be brought about, a result more common in children than in adults.

There can be no doubt that the term "catarrhal ophthalmia" includes a number of different affections which possess certain common features. Be that as it may, three particular clinical forms may be recognised without difficulty.

The first occurs in children or in young subjects, and is characterised by an enlargement of the follicles normally present in the

conjunctiva. These little growths become prominent, and may exist in considerable numbers, especially in the retro-tarsal fold of the lower lid. They are arranged in rows, their colour is reddish yellow, and their size is seldom beyond that of the head of a pin. A further point to be noted in this type is that the tarsal conjunctiva of the upper lid is, so to speak, sprinkled with small whitish growths, flattened as the result of pressure.

The second variety of epidemic muco-purulent inflammation of the conjunctiva is that known to the older authors as Pustular or Aphthous Ophthalmia. The peculiarity of these cases lies in the development of one or several large, yellowish elevations with flattened tops upon the bulbar conjunctiva. These spots are situated not only close to and around the cornea, but also at some distance from that structure; and later on they lose their epithelial covering, rupture, and become converted into greyish ulcers. At the same time, the conjunctiva is the seat of changes like those described in ordinary catarrhal ophthalmia. The affection, so far as I have observed it, is confined to patients under twenty years of age.

Many authorities seem inclined to regard pustular as merely a variety of phlyctenular conjunctivitis. Aphthous cases, however, differ in at least three particulars from the ordinary phlyctenular affection:—(1) Pustular ophthalmia may occur in epidemic form, or, in other words, it is contagious; (2) its elevations are much larger than those observed in phlyctenular disease; (3) it is always associated with marked inflammatory changes in the palpebral conjunctiva, along with a copious muco-purulent secretion. For present purposes, therefore, it may be looked upon as forming a sub-group or variety of catarrhal ophthalmia.

The third variety of catarrhal ophthalmia, sometimes observed in epidemic form, is characterised by a false membrane upon the palpebral conjunctiva. The film is probably nothing more than secretion coagulated by some peculiarity in the inflammation, or, perhaps, by the medicinal agents that have been applied to the eye. Morax,⁴ it is true, has recently claimed that this Croupous Conjunctivitis, as it is sometimes termed, is due to the presence of the

pneumococcus described by Talamon-Fränel in the rust-coloured sputum of pneumonic patients. His observations, however, which were carried out on a limited number of cases, still await confirmation.

It usually commences in one eye, while the second escapes altogether, or is attacked at a later stage. In mild cases the palpebral conjunctiva is covered, wholly or in part, by a delicate greyish film, that may be readily wiped away from the underlying tissues. As a rule, the bulbar conjunctiva is reddened, and a slight amount of muco-purulent secretion is present. In severer cases the signs are more marked. Thus, the pseudo-membrane is thick and ash-coloured. It covers the entire extent of the lids, and leaves a raw and bleeding surface when detached. The retro-tarsal folds and the rest of the palpebral conjunctiva are considerably swollen. The bulbar conjunctiva is much congested, haemorrhages and chemosis are common, and there is a good deal of muco-purulent discharge. In rare instances, the cornea suffers from a curious sort of superficial ulceration.*

In all forms of catarrhal ophthalmia the rule is for one eye to be affected first, and for the other to follow suit three to five days later. Symptoms are always worst at night; and there is a marked tendency to recurrence after apparent cure.

Before leaving this subject, it should be mentioned that a kind of muco-purulent inflammation may be set up by contact with non-

* The following figures are from an analysis of the last 21 cases of this malady that have come under my notice. The ages of the patients ranged from 16 months to 13 years, the average being 75·24 months. Females were affected 8, and males 13 times. Excluding relapses (which were met with thrice), the right eye was involved in 8, the left eye in 7, and both eyes in 6 instances. Membrane appeared simultaneously in 4 of the 6 bilateral cases, but in the remaining 2 an interval of 8 and 13 days respectively elapsed before the second eye became infected. The exudation appeared 1 to 6 days after the first trace of inflammation had been noted. Twice only did inflammation and exudation appear at the same time. Membrane was present nine times upon the upper and twice upon the lower lid, whereas upon ten occasions it was seen on both. The exudation lasted for a period varying from 1 to 20 days, the average being 8·9 days. Some amount of chemosis was noted thrice, and sub-conjunctival haemorrhages twice. In one case alone did any corneal damage supervene, and in that instance it is doubtful whether it was caused by the membranous inflammation. The complications were:—phlyctenulae in 3, and a papular eruption on lids, forehead, and nose, in 2 patients.

specific discharges, such as those from ulcers, abscesses, and skin eruptions. Van Roosbroeck⁵ inoculated eyes with pus from abscesses of the leg, thigh, and mammary gland, but with negative results. Edmonston,⁶ on the other hand, saw severe ophthalmia caused by matter from the dressings of a foul ulcer coming into contact with a patient's eyes. Ware⁷ mentions the possibility of inducing ophthalmia by the application of "variolous and scrophulous matter." Tyrrell⁸ tells of a medical man who contracted acute ophthalmia in consequence of some matter spirting into his eye from a lacunar abscess of the urethra which he had punctured. In that case, however, there is the probability that the abscess was of gonorrhœal origin. At the same time, there is nothing unreasonable in the idea that inoculation with pyogenic organisms, such as *staphylococcus pyogenes aureus* and *albus*, and *streptococcus pyogenes*, may cause a septic inflammation of the conjunctiva. For my own part, I have more than once observed the secretion from an impetiginous eruption of the face give rise to an ophthalmia that resembled the muco-purulent type in its external characters. Indeed, the secondary inflammation of the conjunctiva, now and then associated with blepharitis, is probably produced in this way.

PURULENT OPHTHALMIA is always due to contagion. It is set up by matter that contains a specific micro-organism—the gonococcus—derived from an affected eye, or from some other mucous surface, such as the urethra or vagina. It is one of the most contagious as well as one of the most serious forms of ophthalmia, and, even under prompt and experienced treatment, eyes are not infrequently lost from ulceration or from sloughing of the cornea. In ordinary practice it occurs mainly under two conditions, to which different names are given—Ophthalmia Neonatorum and Gonorrhœal Ophthalmia. The two diseases, however, are essentially similar, in that the specific micro-parasite can be found in both. Their clinical distinctions seem to be chiefly due to differences in the anatomical structure of the parts affected. In the baby, for example, the stress of inflammation falls upon the palpebral conjunctiva, while in the adult the bulbar portion is more seriously affected. Widmark⁹

points out that there is, in adults, a sub-epithelial layer of adenoid tissue, which is absent in newly-born children. He believes that the gonococci have a special predilection for such tissue, in which they find the conditions favourable to their development. The micro-organisms in adults, therefore, penetrate deeply, so that they are difficult to attack with remedies. On the other hand, in children they are lodged more superficially, and hence can be readily acted upon by chemical agents introduced into the conjunctival sac.

In a word, there is but one form of purulent ophthalmia, although its clinical manifestations and its severity may vary. For present purposes, therefore, one common description will suffice.

Purulent ophthalmia, as a rule, attacks one eye in the first instance, although at a later stage both are often affected. The malady makes its appearance usually within three days after an eye has received the contagion. The lids become much swollen, reaching perhaps the size of a Tangerine orange, and the upper often overhangs the lower lid, so that the patient is unable to open his eyes. In severe cases they may be turned inwards upon the eye (*entropion*), or their mucous surfaces may lie exposed to view (*ectropion*). The discharge, blood-tinged for the first three days or so, becomes purulent, and may run from the eye in great quantity, staining everything that it touches a citron-yellow colour. In case the lids can be everted, their conjunctiva will be found greatly swollen, rough, of crimson-lake hue, bathed with yellow discharge, and disposed in horizontal folds. The inner surface of the upper lid is often roughened by the development of closely set protuberances, so that it resembles the pile of red velvet.

At first the patient complains of stiffness and itchiness of the lids, while later on paroxysms of pain may altogether prevent sleep. Lacrymation and photophobia are constant signs. It is a curious fact, which I have often verified, that all subjective symptoms become worse as the day advances, and reach their culminating point in the small hours of the morning.

The preauricular glands (as pointed out many years ago by Hairion,⁹¹ in Belgium, and by Wilde,⁹² in Ireland) become swollen

and tender, and now and then may actually suppurate. In the majority of cases, however, the swelling passes away as the acute stage of the malady subsides.

The conjunctiva of the globe may be so œdematous as to overlap the cornea on every side, or it may even protrude from between the tumified lids and appear upon the cheek as a reddish, tomato-like mass. Under such circumstances, the cornea is often the seat of deep and rapid ulceration, most commonly at its margin, that is, beneath the œdematous conjunctiva. On raising the overlapping membrane, one or more ulcers, often having a greyish look and sloughy surface, may be discovered. They sometimes coalesce with one another, so as to form a trench, which embraces the lower third of the cornea, or may even extend around its whole circumference. Central ulcerations may also occur. If the process be not checked, perforation may take place, and the iris often slips forward into the corneal breach. As a sequel to that accident, adherent synechiae, staphyloma, or septic inflammation of the eyeball may develop.

It is of practical importance to note that ulcers of the cornea that develop late in the disease are seldom grey or sloughy, and are not so serious in their consequences as those that appear during the first week.

The modern view is that corneal lesions are due to an invasion of the *substantia propria* by the specific organisms. The gonococci, it is supposed, gain entrance through a spot left unprotected by epithelium, which may be readily brought about by the careless use of a syringe, or in numberless other ways. There can be little doubt, however, that a potent factor is the presence of the swollen lids and conjunctiva, which seems to lower nutrition, and hence to lessen the resisting powers of the cornea.

Within four to eight weeks, purulent ophthalmia may run its course, and leave the conjunctiva pale and more or less scarred. On the other hand, it just as often ends in a condition of chronic blennorrhœa, which may last, in spite of treatment, for months or even years. In the latter event, the conjunctiva of the lids remains red and thick, while there is a varying quantity of muco-purulent discharge.

The earlier writers held that the purulent disease often ran into "granulated lids," or, as it is now more generally styled, trachoma. According to modern views, however, the latter condition could only result from a further specific infection.

DIPHTHERITIC OPHTHALMIA, as already seen, is rare in England, although common enough in some parts of Europe, as, for instance, North Germany, Holland, and certain districts of France. It is caused by the virus of diphtheria gaining access to the eye, either by direct inoculation, or by an extension of the process from the nasopharynx. Children are more subject to it than adults, and the malady is specially frequent during epidemics of ordinary diphtheria. That it is simply a local form of diphtheria is proved by the following interesting case, related by Fuchs¹⁰ :—A patient with throat diphtheria was placed in the general ward of a children's hospital. Soon afterwards his right-hand neighbour contracted diphtheria of the throat, whereas his left-hand neighbour developed a diphtheritic inflammation of the conjunctiva.

The symptoms of diphtheritic conjunctivitis are usually of a severe character. Thus, the lids have a hard, board-like feel, are hot and tender, and become so swollen that it is often impossible to evert them. Pain is excessive. The discharge, at first thin and sanious, is at a later stage pus-like, with shreds and particles of necrotic tissue, and is said by some observers⁸⁸ to contain the Klebs-Löffler bacillus. The palpebral conjunctiva, as a whole, is swollen, shining, and intensely red, although it may, on the other hand, be firm and lardaceous. The diagnostic feature of the ailment, however, consists of one or more depressed patches of a greyish-white and firmly adherent membrane. In the few cases I have observed personally, a striking point was the existence of a series of small, dusky-red haemorrhages scattered over the surface of the diphtheritic *plaques*. In those cases, too, the preauricular glands were swollen and tender.

The cornea, which may be covered with false membrane, nearly always suffers in severe cases. It may necrose in whole or in part, and cause rapid destruction of sight.

Finally, it is important to remember that small spots of diph-

theritis may be sometimes seen about the scalp, the lids, the nose, the lips, or at the angle of the mouth. General symptoms, as elevation of temperature and great bodily prostration, are often present. Indeed, death has been known to occur: among forty patients, Graefe had three deaths; Gibert¹¹ reported four deaths; and Widmark⁹ had a fatal case.

The existence of a false membrane, the surgeon should carefully note, is by no means confined to diphtheritis. Such a condition, indeed, may be now and then associated with every species of acute ophthalmia. For instance, it is not uncommon in ophthalmia neonatorum, as pointed out nearly fifty years ago by Chassaignac¹²; while a similar statement is true of the other forms of acute blennorrhœa. A pseudo-membrane, moreover, as already mentioned, characterises a special variety of catarrhal inflammation. Membranous exudations may be met with after injuries, whether mechanical, including operations, or chemical—*e.g.*, escharotics, jequirity, and so forth. Lastly, there is a peculiar membranous condition of the conjunctiva, examples of which have been reported by Hulme,¹³ Mason,⁸⁰ Hogg,⁸¹ Nettleship,¹⁴ Critchett, Juler,¹⁵ Bronner,¹⁶ and by Stanford Morton¹⁷ in this country, by Knapp¹⁸ in America, and by Von Arlt,¹⁹ Manz,²⁰ and Zieminski²¹ on the Continent. It is a greyish, fibrinous exudation, constantly reproduced, and seen upon the palpebral conjunctiva for months together. In two of the recorded cases, the membrane was adherent to both lids, forming, as it were, a sort of pocket, which closed the palpebral fissure, and hid the cornea from view. The disease, which does not seem to be contagious, generally occurs in delicate children, and sometimes implicates the cornea.

True diphtheria of the conjunctiva may be distinguished from the preceding spurious forms (*a*) by the presence of the Klebs-Löffler bacillus; (*b*) by the tenseness and rigidity of the lids; (*c*) by the fact that the exudation cannot be wiped away without great difficulty; (*d*) by the cornea being often affected; (*e*) by the fact that it involves an actual destruction of tissue and subsequent formation of cicatrices in the conjunctiva; (*f*) by the swelling of

the preauricular glands; and (g) by the marked constitutional symptoms.

ACUTE TRACHOMA is by no means a common complaint, except, perhaps, in crowded parochial schools. It is for the most part epidemic, although sporadic cases may be met with now and then; and in accordance with a well known law, the congregated are more severe than the scattered attacks. There is every probability that the ailment arises in one way only—namely, through the agency of specific contagion.

As just hinted, the symptoms of acute trachoma present a wide diversity, not only as to their nature, but also as to their results.

Both eyes may be attacked simultaneously, but, as a rule, one is affected three to ten days before the other. The first generally suffers more than the second.

In the worst cases, inflammatory symptoms are so marked as almost to suggest that one has to deal with purulent ophthalmia. Thus, the skin of the lids is reddened, and its subcutaneous tissue thickened by oedema, while a quantity of muco-purulent matter flows from the eye. The free edge of the lid is at times ulcerated, and the lashes glued into bundles by scabs and dried secretion. The greatly thickened palpebral conjunctiva is of a uniform lake colour. It presents numerous ridges and depressions, while many opaque, reddish-grey trachoma-grains, seldom of large size, are scattered over its surface. It should be noted, however, that granular changes may be cloaked by the general swelling and congestion of the conjunctiva that contains them. The extent of the culs-de-sac is often enormously increased, so that fold upon fold of red and tumid membrane springs into view as soon as the lids are everted. The ocular conjunctiva, also, is red and oedematous, but, so far as my experience goes, it never overlaps the cornea, as in purulent ophthalmia. Many of the cases show more or less pannus, which may develop in the course of a single night, and well marked trachoma granules may occasionally be recognised in the cornea. Although not a common complication, ulcers of the cornea are met with at times. The patient complains of pain and discomfort; he

dreads the light, and his eyes often stream with tears when any attempt is made to open them. As a rule, I have found the pre-auricular glands swollen and tender.

In another and milder type of acute trachoma, the lids are not swollen, and discharge is almost or altogether absent. On examining the eyeball, a few vessels are seen shooting across the bulbar conjunctiva, but there is no general redness of that membrane. A common and rather characteristic appearance is that of a zone of superficial congestion—1 mm. or so in width—encircling the cornea, as a tire might bind a wheel. If the chief stress of disease fall upon the upper cul-de-sac, the zone may surround the upper part of the cornea only. The conjunctiva of the lids reproduces to a lesser degree the changes present in the more severe variety. It may be pointed out that the preauricular glands are seldom if ever much enlarged.

Between these two extremes lie a number of cases that show widely differing degrees of intensity.

Symptoms last for a time that varies, not only according to the severity of the original attack, but also according to the treatment adopted. Their progress in a moderately severe case, left to itself, is somewhat as follows:—The discharge lessens, while it changes, at the same time, from a muco-purulent to a mucous character—that is to say, it gets more or less gleety. The lids lose their puffiness, their natural wrinkles reappear, and the patient can once more open his eyes without discomfort. Congestion and chemosis of the ocular conjunctiva become less and less, so that, within three weeks or a month from the commencement of the attack, external signs will have disappeared, except, perhaps, a slight drooping of the upper lids, together with injection and thickening of the caruncles and semi-lunar folds. On evertting the lids, however, the palpebral conjunctiva will be found extensively diseased. It will be infiltrated, ridged, red, and studded by variously sized trachoma-grains, which readily bleed. Numerous small, punctate, red spots will probably be present on the tarsal conjunctiva, especially of the upper lid. The superior culs-de-sac will be filled with semi-transparent folds of reddish-grey trachomatous membrane, that can often be brought into

view by directing the patient to look down while his upper lid is raised by the surgeon's finger. In short, at this stage we shall be faced by a sub-acute trachoma, which is on its way to become chronic.

In attempting to distinguish between the forms of acute ophthalmia, attention must be paid to the *history*, the *signs* and *symptoms*, the *complications*, the *duration*, and the *results* of each individual case. It is of practical importance, however, to remember that diagnosis may be difficult, perhaps impossible, until the characteristic signs of disease have had time to become fully developed. For the first two or three days, therefore, the surgeon must often remain in doubt as to the exact nature of the ailment brought under his notice.

Investigation of the history should never be omitted, as it will now and then throw much light upon the nature of an acute ophthalmia. Thus, we may imagine that a nurse, whilst injecting lotion between the lids of a patient suffering from the purulent disease, receives a spurt of matter into her own eye; or that a surgeon, in endeavouring to separate the tightly closed lids of such a case, meets with a similar accident. Either occurrence will very likely be followed by acute inflammation of the type of the original disease. To take another instance, a physician, engaged in examining a diphtheritic pharynx, may be so unlucky as to have a morsel of the specific membrane coughed into his eye. Here, also, the resulting inflammation will in all likelihood be of diphtheritic type. If a child lying ill with throat-diphtheria develops an acute ophthalmia, the inference will be that the latter is diphtheritic. Again, acute trachoma, let us suppose, is present in a school, and a fresh case has been detected in a ward, up to that time free from the disease. The patient is, of course, removed, but within two or three days a second child, who has slept near the one first attacked, shows inflamed eyes. In such an event, the presumption is that the second individual has caught the contagion from the first, and, furthermore, that the ailment will be identical in both cases. One more instance may be given. Let us suppose that a succession of persons suffering from catarrhal ophthalmia are seen by a surgeon, who, on inquiry, finds that all have come from a certain street, court, or

alley. It is probable that further inflamed eyes from the same place will, other things being equal, be affected with a similar disorder.

Examples such as the foregoing, which are drawn from everyday life, might be multiplied to an almost indefinite extent. But enough has been said to show that valuable evidence is often afforded by an inquiry into a patient's history.

Passing next to *actual signs and symptoms*, in each case a diagnosis must be based upon information derived from three sources, namely—(1) the condition of the eye and of its appendages ; (2) the character of the discharge ; (3) the nature of the subjective symptoms.

Broadly speaking, swelling of the lids will be so great both in purulent and in diphtheritic inflammation as to prevent the patient from opening his eyes. In the first-named malady they are likely to be smooth, tense, and of a purple or livid hue, whereas in the other they present a brawny hardness, that once felt can scarcely be forgotten. Occasionally, moreover, small circular or oval areas of diphtheritis may be observed upon the skin of the lids. The patches are covered with a membrane that reminds one of damp wash-leather, and are surrounded by a zone of redness. In acute trachoma, as already mentioned, the lids may be much or little swollen ; while in catarrhal ophthalmia, as a rule, slight puffiness of their free edges is the only visible change.

In purulent ophthalmia, the conjunctiva of the globe is always oedematous, a condition that goes by the name of chemosis. This red or reddish-yellow semi-transparent swelling is not infrequently flecked with haemorrhagic points and crossed by ramifying vessels. It often overlaps the cornea, which then lies, as it were, at the bottom of a pit formed by a ring of swollen conjunctiva. It may, indeed, be so large as to bulge forwards on to the cheek. At a later stage, the chemosis may become firmer, and persist for a long time in the shape of a number of reddish, flesh-like folds. In diphtheritic conjunctivitis a similar condition may be present, or the conjunctiva may be covered with an ash-grey membrane, that can be separated with difficulty, if at all, from the underlying parts. In the severer form of acute trachoma some slight chemosis may be observed,

although the change, so far as my experience goes, is never so marked as in purulent ophthalmia. As regards catarrhal ophthalmia, chemosis is rare. It is seen only in the most severe cases, and even then is poorly developed. A slightly raised, straw-coloured swelling, which scarcely reaches to the margin of the cornea, may sometimes be noticed, but even that is not common.

It may be well to mention that, in all the foregoing diseases, small patches or dots of haemorrhage are often met with in the bulbar conjunctiva. They are, however, more easily recognised in catarrhal ophthalmia than in the other forms of inflammation.

The state of the palpebral conjunctiva often furnishes materials for a differential diagnosis. In purulent ophthalmia, for example, it bleeds readily, is crimson-lake in colour, and is much swollen, especially in its retro-tarsal parts. Its surface is thrown into folds and ridges, but nothing like the sago-grain elevations of acute trachoma are present. It possesses no trace of membrane, beyond perhaps a false one, that may be easily wiped away. Its so-called papillæ are usually prominent on the upper lid, and produce a peculiar villous or shaggy appearance. In diphtheritic inflammation the swollen and congested conjunctiva shows few or many firmly attached ash-grey deposits, which appear to lie below the level of the surrounding tissues, and which are often the seat of punctate, dirty-red spots, due to haemorrhage. In acute trachoma the palpebral conjunctiva will be markedly thickened, while its culs-de-sac are often folded in a remarkable way. Patches of ecchymosis are observed upon its surface, which is also studded with small, opaque masses, bearing a close resemblance to boiled sago-grains. In the ordinary form of catarrhal ophthalmia the membrane is slightly congested and swollen. It shows, however, neither the grains of acute trachoma, nor the ash-grey and firmly adherent deposits of diphtheritic inflammation.

For diagnostic purposes one can hardly over-estimate the importance of examining the secretion from an inflamed eye.

The discharge of purulent ophthalmia (as indicated by the name) has the characters of pus. It is a thick, creamy, yellowish material,

largely composed of leucocytes, which are often multinucleated and show signs of degeneration. In the earlier stages of the disease it may be tinged with blood derived from the congested conjunctiva, and, in that event, red blood discs are present. Epithelial cells, too, may be always demonstrated. As a rule, its purulent characters are fully established by the fifth day from the time of infection. Its amount is sometimes extraordinary, and far exceeds that from a case of gonorrhœa: Vetch estimated its quantity at several ounces a day. Its main interest, however, lies in the fact that it contains the coccus, first described by Neisser as occurring in gonorrhœa (1879). Whenever the purulent nature of the attack is doubtful, a search should therefore be always made for the micro-organism. Among the various ways of preparing slides for examination, the following will be found both simple and trustworthy. A piece of platinum wire is sterilised by being raised to a white heat. The patient's lids are then everted, and one end of the wire dipped into the discharge. A perfectly clean cover-glass is smeared with the pus, and afterwards slowly passed four or five times over a spirit flame or Bunsen lamp. The next step is to pour a few drops of carbol methylene blue,* or methyl violet,† over the specimen; and after waiting a minute, to remove excess of stain by means of a stream of distilled water, preferably thrown from a wash-bottle. Lastly, the "cover-glass preparation" is again dried over the flame, and mounted in Canada balsam and zylol. Examination with a one-twelfth inch oil immersion lens will show that the organisms are usually arranged in pairs—diplococcus form (Frontispiece, Fig. 1). Small groups of them lie either free in the discharge or within the leucocytes and other cells found in the specimen. It is perhaps worth while noting that they become decolourised by Gram's method. In my experience, these bodies can be demonstrated in every active case of purulent

* Carbol methylene blue is prepared according to the following formula:—Methylene blue, 1 part; absolute alcohol, 10 parts; 5 per cent. solution of carbolic acid, 89 parts.

† Methyl violet is prepared thus:—Methyl violet, 1 part; absolute alcohol, 6 parts; distilled water, 93 parts.

ophthalmia ; and, personally, I should hesitate about diagnosing that affection if, upon repeated examination, I failed to discover the gonococcus.

The discharge from a case of diphtheritic ophthalmia, at first thin and blood-stained, later resembles that of the purulent disease. It may show traces of softened false membrane in the shape of greyish particles and shreds. It does not, of course, contain the gonococcus, but it is claimed^{89, 219} that the Klebs-Löffler bacillus, now held to be characteristic of diphtheritis, can be found in it (Frontispiece, Fig. 6). In order to examine the secretion from such a case, a cover-glass preparation may be made in a precisely similar way to that already described. Under the microscope the organism is seen as a slightly bent rod, the end of which is often distinctly clubbed. It has about the same length as the tubercle bacillus (1.5μ to 3.5μ), but is thicker.

The discharge from a case of acute trachoma is seldom, if ever, so abundant as in the two forms just described. Its character, moreover, is muco-purulent, instead of purulent. In other words, its colour is yellowish-white instead of yellow, and it will contain relatively few leucocytes. There can be little doubt that a specific organism is present, but it has yet to be demonstrated. The micro-parasites described by Schmidt, Sattler,²² Michel,²³ Noiszewski,²⁴ and others have not stood the test of experience.

The organisms shown in the Frontispiece (Fig. 5) were obtained from blood-serum, which had been inoculated with material squeezed from a conjunctiva with chronic trachoma. As will be noticed, they are diplococci, ranging in diameter from 0.6μ to 1.0μ . Whilst I am not prepared to affirm that they are the specific cause of trachoma, the fact is nevertheless significant that they can be demonstrated in a majority of the cases. Further investigations (now in progress) are needed to decide this point.

The discharge from catarrhal ophthalmia, as a rule, is slight and muco-purulent. It is often seen forming strings and rolls in the sinuses of the conjunctiva, and a common and rather characteristic appearance is that of a small collection at the inner canthus of the

eye. In mild cases it is almost imperceptible during the daytime, although the lids, to use a vulgar but expressive phrase, will be "gummed up" on awaking in the morning. Specific and identical microbes have been described by Koch²⁵ (1883), by Weeks²⁶ (1885), by Kartulis²⁷ (1887), and by Morax⁴ (1894). They do not stain by Gram's method, but readily take up methylene blue, and gentian or methyl violet. The bacilli closely resemble those of mouse septicaemia, but are somewhat smaller and have rounded ends. They lie either in the leucocytes or free in the secretion (Frontispiece, Fig. 3). Weeks succeeded in producing muco-purulent conjunctivitis by inoculating the healthy conjunctiva with pure cultivations of the bacillus, while Kartulis, out of six experiments, set up the disease twice. Morax is of opinion that the organisms are constantly present in catarrhal, or, as he prefers to call it, contagious ophthalmia. Although inoculation of a pure culture failed in dogs, monkeys, rabbits, guinea pigs, mice, fowls, and pigeons, yet it succeeded when practised upon his own eye.

In common with other surgeons,²⁸ I have repeatedly found bacilli resembling those described above in the secretion of catarrhal ophthalmia, and I am persuaded in my own mind that their presence may be taken as diagnostic of that disease. On the other hand, their absence does not exclude catarrhal ophthalmia, since I have failed to demonstrate them in a certain proportion of mild cases. The simplest way of recognising the bacilli is by means of a cover-glass preparation, made as described in the case of purulent ophthalmia. They may be met with in large numbers when the malady has attained its height, say, about the fourth or fifth day after infection. Before that period, they can be found in small numbers only, while after it, they become fewer and fewer, and disappear altogether as soon as the discharge has lost its yellowish hue. It has seemed to me that the number of bacilli present is directly proportionate to the severity of the case.

To recapitulate, a profuse flow of pus, in which the Neisser coccus can be found, is an unfailing proof of purulent ophthalmia, while the presence of the Klebs-Löffler bacillus indicates diphtheritic

inflammation. The remaining affections—namely, acute trachoma and catarrhal ophthalmia—are marked by a muco-purulent secretion, usually more abundant in the first named malady. The presence of a small bacillus, with the characters above detailed, indicates that one has to deal with catarrhal ophthalmia. But there can be little doubt that, before many years have passed, a specific organism will be demonstrated in acute trachoma also, so that a diagnosis may be arrived at by a simple bacteriological examination of the secretion. Until that time, however, we must be content to form an opinion from other signs and symptoms, as well as from purely negative evidence.

It may be stated generally that subjective symptoms, as pain, lacrymation, and photophobia are most marked in the purulent and least in the catarrhal inflammations, while acute trachoma occupies an intermediate position in this respect. The temperature may be raised, the pulse quickened, the skin dry, the bowels constipated, and the urine thick—in a word, slight febrile symptoms may be present in almost any form of acute ophthalmia. Those signs, however, are more intimately dependent upon the general constitution of a patient than upon the particular eye malady under which he may labour. To this general statement an exception must be made for the diphtheritic form, a disease in which systemic depression is nearly always a marked feature, and death may result from general infection.

Corneal complications, common in purulent ophthalmia, are nearly always present in diphtheritic cases. They sometimes occur in acute trachoma, but are quite the exception in catarrhal ophthalmia. An epidemic inflammation of the eyes, therefore, that entails damage to the cornea within a few days will be probably diphtheritic or purulent in its nature. On the other hand, an outbreak in which no such damage is observed will almost certainly belong to the catarrhal type. A quickly developed pannus will warn the surgeon that he has to deal with acute trachoma.

The *duration of acute ophthalmia* in individual cases varies within wide limits. Purulent and diphtheritic conjunctivitis retain more or

less of their acute characters for a period that may range from four to eight weeks. Acute trachoma drifts into the chronic form after three or four weeks; and catarrhal ophthalmia may last from three or five days, in slight cases, to three weeks, in the more severe. An epidemic outbreak, then, the symptoms of which, as regards individual patients, are subdued in a few days, will belong to the catarrhal class, whereas conditions that last for a couple of months will certainly fall under another and more serious category.

Apart from these acute conditions, an examination of the eye, conducted at a later period, often furnishes a clue as to the nature of a past epidemic. For example, if the outbreak has been merely one of catarrhal ophthalmia, then a month or so later the eye will be free from redness, the conjunctiva of the lids smooth and pale, and the cornea will show no signs either of past or of present ulceration. In point of fact, the eye will have returned to its normal state. After acute trachoma, however, the condition of things is very different. Thus, the infiltrated conjunctiva will be found deeply congested, and bleeding readily on the least handling. Its retro-tarsal folds will lie in ridges, composed almost wholly of the opaque, grey granulations characteristic of the disease. Pannus may or may not be observed, a remark that also applies to corneal ulceration, past or present. After purulent ophthalmia, the eye often remains in a state of chronic inflammation that may persist for an indefinite period. In such an event, the palpebral conjunctiva is markedly thickened, and remains red and villous, especially as regards the upper lid. Its congested membrane is most likely intersected by whitish-grey bands or patches of cicatrisation, which are sometimes of large size, and may distort the lids by their traction. A characteristic appearance is that of crescentic lines of scarring, the curves of which follow the contour of the lower lid. Now and then one finds the front part of the upper fornix adherent to the edge of the everted upper lid, so that a minute projecting fold, or "ruck," is produced in the conjunctiva. In short, evidence of the former existence of the affection may be obtained years after the attack by examination of the conjunctiva for scar changes. After purulent

ophthalmia, too, corneal damage is relatively frequent, so that ulcers (or the marks left by them), staphyloma, or even loss of an eye, may be met with. The signs of a past iritis, also, may be sometimes observed. Lastly, diphtheritic inflammation, like purulent ophthalmia, leaves the conjunctiva thick, red, and folded; while a further point of resemblance between those two diseases lies in the fact that scar changes are liable to follow both. That is equal to saying that symblepharon, entropion, or trichiasis may be a sequel of either malady.

Of the four acute affections, then, grouped together under the common name "epidemic ophthalmia," three arise from contagion, viz.—purulent and diphtheritic conjunctivitis, and acute trachoma. With regard to the fourth, catarrhal ophthalmia, whatever be its origin, it spreads, at any rate, by transfer of discharge. A proper knowledge of these facts underlies all successful preventive treatment, and furnishes us with the clue to many precautions that might otherwise seem unnecessarily tedious and minute.

In addition to the preceding forms of acute disease, some reference must be made to two chronic affections of the palpebral conjunctiva: trachoma and folliculosis. Those conditions are described in full elsewhere, so that passing mention only need be made of them in this place.

Trachoma is a sharply defined disease of the conjunctiva, due in all probability to a specific micro-organism. Pfeiffer and Ridley,²⁵⁰ however, have recently suggested that it may be caused by parasitic protozoa. As already seen, it may commence as an acute inflammation, but more frequently, perhaps, it is chronic from the outset. However it begins, it is, in my judgment, a malady that originates in contagion, and in that alone. I no more believe in its spontaneous evolution than I do in the *de novo* origin of measles or of ringworm. All the same, trachoma is not equally infectious at all times and under all circumstances. There can be little doubt that its virulence depends on the quantity and quality of the discharge; in other words, on the amount and yellowness of the secretion. It thus follows that the most dangerous epidemics of the acute ailments are those accom-

TABLE CONTRASTING THE FORMS OF ACUTE OPHTHALMIA.

	PURULENT OPHTHALMIA.	MUCO-PURULENT OPHTHALMIA.	GRANULAR OPHTHALMIA.	DIPHTHERITIC OPHTHALMIA.
<i>Cause.</i>	Contagion.	Atmospheric changes? Contagion.	Contagion.	Contagion.
<i>Secretion.</i>	Yellow pus, containing the Merismopedia gonorrhœæ. Profuse flow.	Whitish-yellow fluid, containing small bacilli. Slight flow.	Whitish-yellow fluid. Slight or profuse flow.	Yellow pus, containing the Klebs-Löffler bacillus. Profuse flow.
<i>Lids.</i>	Swollen, tense, and red.	Swollen in severe cases only.	Swollen in severe cases.	Much swollen, red, hot, and board-like.
<i>Palpebral Conjunctiva.</i>	Intensely reddened. Swollen. Uneven surface.	Somewhat swollen and red.	Studded with "granulations."	Swollen and reddened, with opaque, grayish deposits, and ecchymoses.
<i>Bulbar Conjunctiva.</i>	Chemosis marked in adults. Less so in children.	Slight chemosis present in severe cases. Ecchymoses often present.	Chemosis may or may not be present. "Sago grains" observed now and again.	Great chemosis. Patches of false membrane often noticed.
<i>Cornea.</i>	Often involved.	Rarely affected.	Sometimes attacked.	Often involved.
<i>Subjective Symptoms.</i>	A good deal of pain and "stiffness of lids." Much watering of eyes, and dread of light.	Not marked.	Seldom much pain.	Severe pain, photophobia, and lachrymation.
<i>General condition of Patient.</i>	A certain amount of constitutional disturbance not infrequent.	Good.	Good.	Fever, with systemic depression: a fatal result not unknown.
<i>Associations.</i>	Synovitis of large joints, as for example, the knee, the elbow, the wrist, and the ankle.	Nil.	Nil.	Diphtheritis of skin or mucous membranes.
<i>Pre-auricular Glands.</i>	Glands swollen, tender, — may even suppurate.	Usually unaffected.	Swollen in severe cases only.	Much swollen and very tender.
<i>Duration.</i>	4 to 8 weeks.	3 days to 3 weeks.	About 1 month.	4 to 8 weeks.

panied by a good deal of muco-purulent secretion. On the other hand, a trachoma, whose active symptoms are held in check by systematic treatment, will in all likelihood possess but slight powers of contagion.

If trachoma be in reality contagious, how is it that one finds it every now and then limited to a single eye? The answer to this question is bound up in what has been just stated, namely, that it is contagious only under certain conditions. If in the acute stage the disease be unilateral, the second eye may remain free, even though the malady may persist for years in the one first affected. More commonly, however, the second eye is sooner or later involved, a fact that has been plainly shown by the investigations of Germann and of Raehlmann. Among a considerable number of patients, those observers found that in the early stage of trachoma 13 per cent. had one eye intact; in the later stages the proportion had sunk to 9 per cent.; while in the cicatricial stage only 0.5 per cent. had unilateral trachoma. As pointing in the same direction, I have myself upon more than one occasion witnessed the gradual infection of an eye hitherto healthy from another affected with chronic trachoma. I may add my conviction that almost all instances of one-sided disease will be found upon enquiry to have had an acute rather than a chronic origin.

There are two fallacies that must be constantly borne in mind with regard to this question. The first is, that a considerable interval of time may intervene between the onset of symptoms in the two eyes. It may thus happen that we are consulted by a patient with unilateral trachoma; but it would be unfair to found any argument against the contagious nature of the ailment upon that fact, inasmuch as the other eye, as shown above, is likely to become infected at a later stage. The second fallacy is, that a seemingly one-sided case may upon closer examination turn out to be bilateral. The apparently healthy eye, for example, may manifest some faint scarring of the palpebral conjunctiva, some reduction in the depth of the cul-de-sac, or other unmistakeable though perhaps slight sign of past mischief.

The course of trachoma is tedious, and even under the best treatment, it lasts for months or years. The ailment is a serious one, and

frequently entails damage to sight. It is rarely met with in high-class schools, but is common in parochial institutions, and there can be no doubt that it lies at the root of many epidemics of ophthalmia among the children. This fact admits of a simple explanation. The subjects of trachoma are apt to get their eyes acutely inflamed from causes of a more or less trivial nature, such as measles, dampness of the air, increased velocity of the wind, and so forth. The disease accordingly may be passed from child to child, and what was originally a chronic affection limited to a few cases may speedily develop the characters of an acute ailment affecting many. Insanitary surroundings, by multiplying opportunities for the fostering of contagion, have a marked influence both upon the spread and the malignancy of the disease. After the epidemic wave has passed away, it will be found—first, that the condition of those who originally suffered from trachoma has altered for the worse; and, secondly, that a fresh crop of cases has arisen. This circle of events may be repeated again and again until the school is packed with trachomatous patients, and becomes, as it were, a forcing-house for the growth of ophthalmia, and its propagation among new comers.

A reference must be made to folliculosis, inasmuch as there is reason to believe that it is often confounded with trachoma. It bears, indeed, a superficial resemblance to that disease, although its causes, its course, and its consequences are altogether different. Thus, it is not contagious, and never damages sight. The ailment ends spontaneously, and is often so slight that those affected do not know that there is anything wrong with their eyes. In my own mind, I have no doubt that the follicular condition is in many instances natural to the conjunctiva of young subjects, and in support of that statement I adduce the fact that among 14,797 scholars whom I examined a few years ago, 13,908 showed some trace of folliculosis. The investigation, as will be seen from another paper, did not include the inmate of a single parochial school.

It is of the greatest importance that medical men in charge of schools should be able to distinguish between trachoma, on the one hand, and folliculosis, on the other.

Our next step will be to consider the various ways in which epidemic eye disorders are propagated. In the following remarks the term "ophthalmia," when used alone, will include all conjunctival diseases attended by discharge, whether purulent, muco-purulent, or mucous in nature.

Von Graefe and his followers held that every discharging inflammation of the conjunctiva was contagious, and that secretion from such a case might infect another eye without necessarily setting up the original disease. They were of opinion that the matter furnished by a mild, or catarrhal, affection might give rise to a severe, or purulent, one, and *vice versa*. To that extent, then, they regarded the contagious ophthalmiæ as forming a series of closely related and interchangeable maladies, ranging from the muco-purulent to the purulent type ; or, in other words, that these were not pathological entities, but rather the varying results of a common inflammation. Their views, when carried to a logical conclusion, can bear no other interpretation.

In the light of modern scientific knowledge, however, the foregoing hypothesis can be no longer maintained. It has been proved beyond a doubt that the purulent affection is due to a well-defined micro-parasite, while it is more than probable that diphtheritis is also caused by another specific microbe. Moreover, our bacteriological and our clinical knowledge of the two disorders coincide. We know, for instance, that virus derived from one does not produce the other, and that neither is capable of setting up any other form of inflammation. An inoculation from a muco-purulent case will cause muco-purulent and not purulent ophthalmia ; and, so far as we know, the discharge from trachoma reproduces its kind, and does not give rise to an alien disorder. Indeed, the facts at our disposal indicate that these various disorders are one and all specific in the full sense of the word. It may be taken as granted, therefore, that catarrhal is not likely to run on into purulent ophthalmia, and that discharge taken from an eye with a particular ailment will give rise to that ailment and to no other when introduced into a second eye.

It must be admitted, nevertheless, that the reproduced may differ from the original malady in certain points of detail. In other words, variations may occur, not only according to the soil upon which the virus is planted, but also according to the modifications that the virus may have undergone in the tissues of its former host. Thus, one and the same cultivation of the catarrhal ophthalmia bacillus may give rise, now to slight and now to severe inflammatory symptoms. In all the cases, however, the characteristic bacilli can be demonstrated. It is a matter of common knowledge, too, that epidemics of the same disorder may, upon different occasions, develop characters of various type. Scarlet fever, for example, may at one time be marked by trifling throat symptoms and a low death rate, while at another the exact converse may occur. The same sort of thing happens in the case of contagious eye disease. On one occasion purulent ophthalmia may show a special tendency to involve the cornea ; while on another the disorder may spread with unusual rapidity. A similar tendency to variation of type is observed in outbreaks of muco-purulent conjunctivitis and of acute trachoma. In short, every epidemic may be said to possess its own peculiar features as to severity, spread, complications, and sequelæ.

There are three points, it may be added, in which almost all epidemics of ophthalmia agree. The first is, that the greater the number of cases, the more severe will be their type ; secondly, that the severity of the malady stands in direct ratio to its rapidity of spread ; thirdly, that the earlier cases are more virulent than the later ones. The last point may probably be explained by a change undergone by successive generations of the specific microbe. An almost exact analogy is afforded by a fact that has repeatedly fallen within my own observation : when an acute ophthalmia, limited at the outset to one eye, infects the remaining eye at a later stage, the secondary inflammation is almost invariably of a milder type. This may be reasonably explained, I think, by the assumption that attenuation of the virus has gone on in the first eye.

Another theory that calls for passing mention is that of Arlt, Goldzieher, Fuchs, and other continental observers, who maintain

that all forms of contagious ophthalmia originate from the genital organs. Arlt¹⁹, who was the first to give expression to the idea, explains the sequence of events thus: "I regard it, therefore, as most probable that the so-called granulosa is not a disease *sui generis*, but only a modified blennorrhœa, a disease originally arising from a genital blennorrhœa, being transferred to the eyes, which has lost in virulence but gained in persistency, through transmission from eye to eye, from individual to individual, and might be again intensified to its highest degree by unfavourable external influences." In support of that theory, Goldzieher²⁰ has related a chapter from the history of the Budapest Blind Asylum. It seems that purulent ophthalmia was introduced into the institution by an infected child, and that ultimately the whole of the male and most of the female inmates became affected. Among these patients, every form of conjunctivitis—from blennorrhœa to trachoma—was found. Cases of a somewhat similar kind have been recorded by other observers, notably by Sattler²² and by Hoor.²³

Before Arlt's hypothesis can be accepted, a rigid examination of the facts must be made, in order to exclude the fallacies that surround so difficult a subject. In Goldzieher's case, for example, an answer would be required to the following questions:—(1) What were the primary causes of the blindness for which children had been admitted to the asylum, and had all original trachomatous patients been cured? (2) Was the new-comer himself perfectly free from that ailment, or did he, on the other hand, suffer from a purulent ophthalmia engrafted upon a pre-existing trachoma? Without definite evidence on these and cognate points, it would be impossible to reach a trustworthy conclusion. As a matter of fact, there seems to be one way only of testing the truth of the theory, namely, by experiment. Thus, among other things, it would have to be shown that the coccus of purulent ophthalmia was capable of attenuation when grown in artificial media, and, further, that when inoculated, such attenuated virus gave rise to trachoma.

These interesting points, however, lie somewhat beside our present purpose, viz.—to enquire into the means by which ophthalmia is

spread in schools and other places where human beings are closely congregated.

The epidemic prevalence of any disorder forms *prima facie* evidence of its infectious nature, and the proposition that ophthalmia is "catching" scarcely calls for formal proof. Apart from a large amount of experimental evidence, the life history of the disease testifies to its contagious nature. Its appearance as a wide-spread outbreak was preceded by the arrival of infected soldiers, and the scourge spread in the first place in their immediate neighbourhood. The persistency with which it clings to certain bodies of men, as well as the fact that rigid isolation forms the best preventive treatment, tends to prove that ophthalmia is essentially contagious.

Granting that such is the case, there are two theories to be considered. The first is that of AERIAL INFECTION, the second that of CONTAGION, *i.e.*, the transfer of morbid particles from eye to eye, either directly or indirectly by washing materials, fingers, handkerchiefs, bed-linen, toys, flies, and other intermediate agencies.

The supposition that ophthalmia spreads through the air dates from an early period, and was firmly held by many writers during the first decades of the present century. Thus, Müller (1821), a surgeon in the Prussian army, believed that aerial infection was the usual mode by which the disease spread from soldier to soldier. He expressed his conviction that three conditions were necessary to bring about this result: (1) the presence of a patient suffering from ophthalmia; (2) an atmosphere polluted by human exhalations; (3) the existence of currents of air capable of conveying the *materies morbi* from person to person. At the same time, Müller did not deny that contagion—that is, actual contact—had a share in the matter, notwithstanding the fact that his own experience had failed to furnish him with direct proof of its occurrence. Burkard Eble³¹ (1828) held a similar view. Decondé³² (1837) was a firm believer in air-borne ophthalmia, and in support of that view adduced some observations which are more interesting than conclusive. He narrated, for instance, the following case. A soldier, named Opdenkamp, suffering from the disease, returned to his family,

which consisted of six or seven individuals, all of whom contracted ophthalmia. According to Deconde's account, the disease passed from one to the other despite every possible precaution to prevent its spread. The same author made a curious experiment, in which a piece of linen, impregnated four months previously with purulent discharge, was fixed in front of a dog's eye in such a way as to touch neither the lids nor the globe. As a result, palpebral granulations were said to have made their appearance.

Our own countryman, Sir Thomas Watson³³ (1848), held that purulent ophthalmia could be communicated, not only by contact, but also by transmission of the specific poison for a short distance through the air.

Hairion³⁴ (1859) was firmly impressed with the idea that ophthalmia could pass through the air. In order to prove the miasmatic spread of disease, he related the following cases. Between March 15th and 21st, 1842, 580 recruits were drafted upon a certain regiment. Hairion examined the eyes of all the men, and separated those whose lids were affected. The rest of the soldiers were lodged in some barracks, formerly occupied by a battalion with granular ophthalmia, a malady, however, that had been extinct for eighteen months. The new-comers were served with bedding that had been used, two years before, by a regiment that contained many ophthalmic patients. On April 2nd, Hairion discovered that two of the recruits had "vesicular granulations in the external canthus of the inferior palpebral conjunctiva." On the 9th of the same month, five fresh cases were found; on the 16th, three; and on the 22nd, six. Finally, on the 29th of April, four more cases were detected. To sum up the facts, then, during a stay of forty days he discovered twenty recruits with vesicular granulations.

In 1843, 600 recruits were lodged in a large building, occupied, three years before, by an infected regiment. The ground-floor rooms, as well as the bedding, had been disinfected. The men who slept in those apartments remained free from disease, but thirteen cases of granulations occurred among those quartered in other parts of the barracks.

In 1844, there were 600 new arrivals, who were drafted upon the same quarters as those just mentioned. This time, however, the precaution had been taken to disinfect all wards and all articles of bedding. No instances of palpebral granulations were observed.

Hairion related another case communicated to him by a Portuguese surgeon. It seems that purulent ophthalmia had been endemic for many years at an orphanage in Lisbon. The institution was therefore abandoned. Six months later a regiment was quartered in the old premises, and several soldiers were attacked by purulent disease.

As to the last case, it is exceedingly unlikely that the virus of purulent ophthalmia could cling to a building for so long a time as six months, and yet retain its infective qualities. The gonococcus, as we know, possesses but slight powers of resistance. It neither forms spores, nor does it lead a saphrophytic existence outside animal tissues. It is, moreover, easily killed by dessication. It would be a more rational hypothesis to assume that the epidemic among the soldiers was the result of infection by blennorrhagic pus.

With regard to the other cases, it must be pointed out that the term "vesicular granulation," used by Hairion, is somewhat misleading. If by that expression he meant what I have described under the name of "Folliculosis," then two facts must be borne in mind, viz.—(1) that the most careful observer may fail to identify small growths, especially when the mucous membrane is congested; and (2) that the follicular granulation may possibly increase in size under the influence of an imperfect sanitary environment, apart from all question of contagion.

Warlomont,³⁵ in 1856, wrote of aerial infection as follows. "It must be remembered that despite the large number of facts that have been published, and the high standing of those who have written upon the subject, there is not at this moment a single and incontestable proof of this mode of transmission." In order to settle the point, he proposed two crucial experiments. In the first, several dogs, some sound and others with ophthalmia, were to be lodged in

one room, and the healthy were to be prevented from coming into contact with the diseased. In the second place, he suggested that a dog free from disease might be shut up in a room containing a large quantity of linen that had been impregnated with ophthalmic pus; the arrangements being such that the animal could by no possibility get at the contaminated rags. If in either of these tests healthy animals contracted the ailment, then it would be necessary to admit the possibility of an aerial transfer.

Nearly forty years have elapsed since Warlomont made his proposals, but, so far as I am aware, nobody has yet thought it worth while to put them into actual practice.

Marston instituted some experiments to show that a strong atmospheric current, when driven over recent pus, was capable of carrying the globules along with it, while Eiselt found pus cells free in the air of an ophthalmic ward. These facts, although interesting, prove nothing as to infection at a distance. Aerial infection implies that transported germs are able to withstand drying without losing their vitality, an assumption that we know to be unfounded,—at any rate, as regards the gonococcus.

Many and ingenious attempts have been made to explain the exact way in which infectious molecules may be disseminated through the atmosphere. Decondé imagined that watery emanations arose from diseased eyes, filled the air, and attached themselves to any hygroscopic substance they might come against. The particles, according to his view, would be subsequently set free by heat and dryness, so that they might lodge in healthy eyes, and thus set up the original ailment. A second explanation assumed that the small bubbles of water—known to exist in air—might act as the medium for transporting infectious material. Another theory was that discharge ran through the tear passages into the nose, and was then thrown into the atmosphere during the act of expiration. Lastly, it has been suggested that morsels of dried pus free in a ward might be active agents in the spread of ophthalmia.

The theory of air-borne ophthalmia has been opposed by many observers who have had opportunities of watching outbreaks of the

disease on a large scale. Thus, MacGregor was of opinion that the ailment spread "by the purulent matter of a diseased eye being applied to that of a sound person," and he mentions no other mode of dissemination. Vetch,⁹⁶ principal medical officer to the Ophthalmia Military Hospital, held a similar view, and went so far as to assert that those in attendance upon ophthalmic patients never contracted the disease, although constantly exposed to the infection.

Prunér⁹⁶ made the statement that during a period of twenty years, not a single surgeon practising in Egypt contracted ophthalmia. "In 1836," he added, "I had the management of two hospitals, which admitted during the course of several months 3,000 cases of purulent ophthalmia, furnished by Egyptian and Syrian regiments. Last year 20,000 patients came to the hospital, yet not a single instance of infection was observed among the members of the staff."

Raehlmann,⁹⁷ after a large experience of trachoma, has expressed his conviction that the disease is incapable of atmospheric dissemination. He pointed out that in his hospital the attendants, who slept in the same ward with the patients, did not contract the disorder. "I have myself," he writes, "been accustomed for more than five years almost daily to examine the conjunctiva as closely as possible with a magnifying glass without experiencing any damage from that method of investigation."

At the Ophthalmic School, Hanwell, where every kind of contagious ophthalmia is admitted, no instance of air-borne disease has been recognised. The institution has been occupied for nearly five years, yet not a single nurse, out of the sixty-five who have worked in its wards, has contracted the disorder. Moreover, none of the sixteen teachers have been infected, notwithstanding the fact that they necessarily come into close contact with patients. Further, none of the wardmaids or other servants have been attacked. Had ophthalmia been capable of transmission through the air, it must surely, according to the law of averages, have affected many of these exposed individuals. The fact is significant, too, that all preventive measures have been based on the theory that contagious eye maladies are spread by the direct or indirect conveyance of specific discharges from eye to eye.

It will thus be seen that I am in a position to confirm Raehlmann's views generally. I may add that for some years I have made a point of examining ophthalmoscopically all newcomers to the Ophthalmic School, yet I have not contracted any disease in that way.

One could conceive that under conditions of gross mismanagement ophthalmia might disseminate itself for a short distance through the medium of the air. It is possible that the disease might be spread in that way if sick and healthy persons were herded together in one small room ; if discharge were permitted to saturate all the patient's clothes and surroundings ; or if ventilation and the laws of common cleanliness were disregarded. But even under such circumstances, it would be impossible to say how much was due to infection and how much to contagion, a fallacy which vitiates all the instances brought forward to prove the aerial passage of ophthalmia. In short, it is out of the question to establish either a negative or a positive as to the spread of the disease by infection. Nevertheless, all available facts appear to warrant the conclusion that ophthalmia is propagated mainly, if not exclusively, by actual contact. From this general statement, however, diphtheritis must be excluded, since that ailment appears to be capable of spread, not only by direct contact, but also through the air.

We shall next consider some of the evidence bearing upon the contagious dissemination of ophthalmia. Many of the arguments will be based upon *data* derived from the purulent disorder, which has been selected as typical of all the contagious ophthalmiæ. It is impossible to deny that what is true of that malady may not be also true of any inflammation of the conjunctiva associated with a specific discharge of pus or muco-pus.

There are two ways in which specific matter may reach the eyes, namely, by direct or by indirect transference.

Many examples of direct transfer are recorded. So long ago as 1820, it was shown by Ghillié²⁸ that discharge taken from muco-purulent ophthalmia, and applied to a sound eye would give rise to a similar affection. The experiment has often been repeated since his time, as a rule, with positive results. Only recently Weeks²⁶ inoculated six healthy eyes with matter from catarrhal ophthalmia, and

in five of those cases the original disease was reproduced. It must be admitted, therefore, that the muco-purulent affection is inoculable. As to diphtheritic inflammation, a case mentioned by Arlt¹⁹ affords conclusive evidence of direct transfer. One of his colleagues, whilst treating a diphtheritic throat, received some muco-pus in his own eye. Although the latter was at once washed out, yet a diphtheritic inflammation speedily developed, and led to total destruction of the cornea. Two similar cases have been reported by Greenhow.⁹⁸ Van Millingen³⁹ repeatedly produced trachoma by inoculating the healthy conjunctival sac with discharge from acute or chronic cases of that malady.

There is abundant proof that purulent ophthalmia may be set up by the application of specific discharges taken from the urethra, vagina, or eye. Astruc²¹⁸ (1737) related the following instance:—“A young fellow used every morning to wash his eyes with his own water to strengthen his sight. At length he had the misfortune to catch a clap, but he did not in the least refrain from his usual custom, apprehending no harm from it, but the urine partaking of the infectious matter, quickly communicated the same disease to the tunica conjunctiva of the eye and the eyelids, with which the genital parts were affected; from whence proceeded a violent venereal ophthalmia, attended with a sharp involuntary discharge of tears and blindness, which were both cured by the same remedies as the clap itself.” Chandler⁴⁰ mentions the case of a young man who contracted a “severe venereal ophthalmia” by washing his eyes with urine whilst suffering from gonorrhœa. Swediaur (1784) mentions one, and Foot⁹⁵ (1820) two cases of the kind. Wellbank,⁴¹ also, has known ophthalmia to be the consequence of ablution of the eyes with the urine during the existence of gonorrhœa. Two good instances of direct inoculation have been recorded by William Lawrence.⁴² The first occurred in a young man who was foolish enough to attempt to relieve some slight ocular irritation by washing his eyes with his own urine, having been told by a friend that it was an efficacious remedy. Examination disclosed the fact—denied by the patient—that he was labouring under specific urethritis. In the second case,

a young woman with the same contagious complaint contracted purulent ophthalmia in a similar way. Dixon⁴³ gives full details of an analogous case observed in a young labouring man. In point of fact, this mode of transference is so common that most people who have much to do with eye ailments must have met with examples of it.

Mackenzie⁴⁴ mentions a patient who, whilst removing discharge from his urethra, threw a drop of matter into his eye, and contracted purulent ophthalmia. One of Fuch's colleagues, when injecting a case of gonorrhœa, lost his eye by getting it infected by a spurt of pus.⁴⁵

Lastly, not so many years ago, it was a recognised method of treatment for pannus to inoculate eyes with purulent secretion, obtained as often as not from the urethra.

The well known association between ophthalmia in the child and purulent vaginal discharge in the mother*—pointed out in 1807 by Benjamin Gibson,⁴⁶ of Manchester—affords strong evidence of the connection between the two conditions. It need not be enlarged upon in this place.

There have been numerous instances where the infective virus has come direct from a diseased eye. Kerchhove and others produced purulent ophthalmia in human beings by introducing into a sound eye pus from a diseased one. Animals have also been infected in that way. Apart from experiment, however, the same sort of thing has often come about accidentally. MacGregor⁴⁷ has given an account of a nurse, employed at the Royal Military Asylum, who, whilst syringing the conjunctiva of a child, received a spurt of matter into her own eye; within twenty-four hours, symptoms of purulent ophthalmia developed. In attempting to examine an eye with contagious ophthalmia, Cunier, a Belgian oculist, met with a similar accident. I have myself known three instances in which acute trachoma was contracted in this way; while I have heard of many

* Hirschberg has recently insisted that the relation between maternal discharges and ophthalmia neonatorum was noted in 1750 by Quellmalz in a work entitled "De cœcitate infantum fluoris albi materni ejusque virulentí pedissequa."—*Centralbl. f. prakt. Augenh.*, Leipzig, February, 1894.

others. Perhaps the most remarkable case of the kind, however, was that narrated by Dr. Bessinger⁴⁸: A Bavarian physician, named Kraft, lost his right eye through touching it with a finger soiled with the discharge from ophthalmia neonatorum. Pus taken from his eye was next placed in contact with another eye, which, within five days, was affected with purulent disease. But the experiment did not end there; for a portion of discharge from the last eye was introduced into the urethra of an idiot. Within three days, gonorrhœa was set up, a disorder that was then communicated to two other persons. Finally, pus from those cases was put into an eye, where it gave rise to purulent inflammation.

For my own part, I have known two or three instances of nurses who contracted ophthalmia by taking an affected child into the arms for purposes of nursing; mothers and attendants in lying-in hospitals seem often to have caught the purulent disorder in this way. Contagion has been also passed by the act of kissing. In these cases, infection probably comes about through direct transfer of the specific virus.

It seems as though the *materies morbi* may find its way through the tear passages into the nose, and then be thrown out, literally, as a spray of contagious particles by the act of sneezing. There is reason for believing that ophthalmia has been thus passed. At any rate, I knew a nurse who asserts that she contracted trachoma by that means, and I have heard of other cases. Sneezing, it is well known, is often reflexly induced when any attempt is made to separate the lids of certain patients.

Direct transference, then, is proved, (1) by the experimental inoculation of men and of animals; (2) by the accidental infection of human eyes; (3) by auto-inoculation, as when a contagious discharge passes from the diseased into the healthy eye of one and the same patient.

It is probable, however, that direct is by no means so common as indirect contagion, although the latter is obviously less open to proof. The most likely agents in passing on infectious particles may be thus enumerated:—

1. Washing utensils.
2. Hands and fingers.
3. Handkerchiefs.
4. Bed linen and body apparel.
5. Animals.
6. Miscellaneous agents.

1. *Washing utensils*.—That ophthalmia may be communicated to healthy persons by the use of infected washing materials is not an altogether modern view. So long ago as 1808, James Ware⁴⁹ wrote as follows: “The most natural explanation appears to me to be that this particular disorder is only communicable by actual contact, that is, by the application of some part of the discharge which issues either from the tunica conjunctiva of an affected eye, or from some other membrane that secretes a similar poison, to the tunica of another person. That such a mode of communication did prevail in several of the regiments in which the disorder raged with the utmost malignancy in the last year is, I believe, admitted both by the surgeons who belonged to those regiments, and by the medical inspectors who were appointed to inquire into it. I can aver that the same effect has been produced by a similar cause in schools and nurseries, in both of which, from inattention to a rule which I believe of much importance, though too little regarded—of hindering the hand basins and towels, which have been used by persons who have this disorder, from being employed by others before they have been thoroughly cleansed—the ophthalmia has been communicated to nearly twenty in one school, and to the nurse and several of the children in more than one school.”

Many writers, both ancient and modern, have endorsed Ware’s views as to propagation. Thus, Farrell, Vetch, Lawrence, Soelberg Wells, Gross, Carter, Berry, Frost, Fuchs, De Wecker, Juler, Swanzy, De Schweinitz, and Von Arlt draw attention to the point.

Those who have had to do with ophthalmia in the parochial schools of the metropolis have, almost without exception, insisted on the dangers of common washing. Dr. Mouat⁵⁰ and Dr. Bridges⁵¹ who reported to the Local Government Board in the

years 1873 and 1874, have spoken emphatically with regard to this point. Mr. Nettleship, however, seems to have arrived at a different opinion. In his well-known report,⁵² published in 1874, he stated that he had failed to trace any constant relation between the lavatory arrangements and the ophthalmic state of the schools, and that those arrangements were carried out just as well in institutions that showed a large amount of disease as in those that suffered lightly. After a careful review of the evidence, he was not disposed to attribute much importance either to water or to towels as vehicles for contagion.

Any views coming from so distinguished an authority deserve careful consideration. At the same time, one must not forget that the statistical method—on which he appears to found his conclusions—is surrounded with pit-falls. For instance, a fallacy lies in the fact that the greater the amount of the disease in any given school, the more attention would naturally be devoted to its sanitary administration. We may thus explain the seeming anomaly that at Hanwell, where much ophthalmia existed, the supply of clean towels and of water was practically unlimited,—unlimited, in short, because of the disease.

Mr. Nettleship's words amount, after all, to little more than a carefully qualified expression of opinion; and his failure to associate imperfect washing arrangements with the spread of ophthalmia cannot, by any means, be accepted as proof that the two conditions are not related in fact. His statements possess a negative value only. Anyway, it should be noted that he does not allow any theory of the kind to influence his views upon preventive treatment. "I hasten to add," he writes, "that I should on no account allow the slightest relaxation in respect to washing and bathing. I should make an abundant supply of clean water and towels, both for daily washing and bathing, essential."

Thus far we have been dealing with individual opinions rather than with ascertained facts. It may at first sight seem curious that comparatively few observations, experimental or otherwise, have been recorded to show the connection between washing arrangements and ophthalmia. This omission is doubtless due to the fact

that actual proof is not easy to obtain in our present state of knowledge ; indeed, as regards the specific agency of water, it must nearly always be of an inferential nature. Towels, sponges, basins, and water form a part only of the many means by which the seeds of infection may be scattered around, and it would be difficult, if not impossible, to prove that in any given instance they and they alone were to blame. In such a case, results must almost necessarily be founded upon a process of exclusion.

Towels and sponges would seem to be more likely agents than water in the spread of the disease ; that they are so in point of fact has been shown by a certain amount of direct evidence. For instance, the following case, which occurred during an epidemic of ophthalmia in Chelsea Military Asylum, was recorded by MacGregor.⁴⁷ A nurse, engaged in washing the eyes of a patient, inadvertently applied the sponge that she was using to her right eye. Although she mentioned this occurrence to the other nurses, no means were taken to prevent evil consequences. Eight hours afterwards, her eye began to feel uncomfortable, and next morning the disease was fully established. Another striking case was narrated by Delpech.⁵³ A young woman washed her eyes with Goulard water and a sponge, both of which articles had been previously employed by a youth suffering from gonorrhœa. She was shortly afterwards attacked with violent ophthalmia, which led to loss of sight. Benjamin Travers⁵⁴ spoke of having seen ophthalmia set up "by the use of a sponge which had been recently employed to cleanse the eyes of an infant affected with the disease." Widmark⁹ has published an account of two little girls with purulent ophthalmia, in the discharge from whose eyes gonococci were detected. The mother was found to be labouring under an attack of genital blennorrhœa, and Widmark is of opinion that contagion was carried from the woman to her children by the common use of a toilet sponge. Hirschberg²⁴⁶ attended a child who contracted purulent ophthalmia by the use of a sponge infected from another eye. Lawrence⁴² tells of a footman who contracted purulent ophthalmia through wiping his eyes with a towel that was contaminated with gonorrhœal secretion. Tyrrell⁸

records the case of a woman, who occupied a room with her son, a young man about twenty-six years of age, who had contracted a similar infectious disorder. She used a towel that had been soiled by her son, and in consequence contracted purulent inflammation of the eyes, which ended disastrously in three days.*

Other instances of a similar kind are scattered throughout the literature of ophthalmia, and there can be no doubt that purulent disease has been spread by the indiscriminate use of towels, sponges, and other articles of the kind. That which is known to be true of purulent ophthalmia we infer to be also true of any ophthalmia accompanied by specific discharge.

It has been already remarked that evidence as to the actual agency of water in the spread of infection must nearly always be inferential rather than direct, suggestive rather than conclusive. In other words, that proof positive of such a connection cannot be generally obtained.

There are two well known experiments, however, that may be accepted as positive evidence of the reality of water-borne ophthalmia. The first was carried out by Vasani⁵⁵ at the commencement of the present century. That observer communicated ophthalmia to a dog by dipping it into water in which the eyes of two other animals labouring under the disease had been repeatedly washed. A similar sort of experiment was carried out by Van Roosbroeck,⁵⁶ with the object of determining whether the specific virus lay in the pus or mucus cells, or in the fluid that held them. He caused some patients with purulent ophthalmia to bathe their eyes in a limited portion of water. The latter was then divided into three parts, of which one was submitted to the action of heat, to another chloride of lime was added, while the third was neither heated nor mixed

* Instances of the reverse association have been recorded, and Dr. D. Watson Geddie has recently described a case in point. That gentleman was consulted about two little girls suffering from a vulvar discharge. He found that their mother had been lately confined of a baby who developed gonorrhœal ophthalmia. Although warned as to the infective nature of the pus, this woman had used towel, employed for wiping the infant's eyes, to dry the genitals of both children.—*Brit. Med. Journ.*, London, Feb. 24, 1894.

with chemical agents. Eyes with pannus were next inoculated. It was found that, while the first and second of the portions produced no effect, a single application of the untreated fluid sufficed to set up the original malady.

A curious case, tantamount to an experiment, has been related by Cullerier.⁵⁷ A patient with specific urethritis wore an artificial eye, which he was accustomed to place in a tumbler of water overnight. He was suddenly seized with an intense inflammation of the orbit, accompanied by a profuse flow of pus from that cavity. On enquiry, it was found that the tumbler had been used for toilet purposes. Cunier²²³ reported two instances in which patients contracted gonorrhœal ophthalmia by washing in water similarly contaminated. These cases prove conclusively that water may hand on contagion.

Piringer⁵⁸ attempted to show that specific discharges lost their infective properties when diluted with a sufficiency of water. According to his investigations, the most virulent pus was rendered inactive by the addition of 50-100 parts of water. It is more than doubtful, however, whether mere dilution would sterilise the germs of purulent ophthalmia. If we regard water as merely distributing the poison, a much diluted drop is less likely to contain enough virus to set up specific inflammation in an eye.

During the discussion on military ophthalmia at Brussels in 1859, more than one speaker insisted upon the fact that pus retained its contagious properties, even although it was thrown into a large quantity of water.

In order to arrive at some conclusion with regard to this disputed point, a series of experiments have been recently made by Mr. Walter Severn and myself, with pure cultivations of the gonococcus. Inoculation was, of course, out of the question. It became necessary, therefore, to assume that whenever the organisms after dilution could be grown on blood serum, that they could also give rise to purulent inflammation when introduced into an eye. The experiments may be thus epitomised:—(1) Fragments of blood serum with adherent cocci were scraped from the surface of a cultivation, and diluted to.

4,000 times their bulk with sterile water. Four hours later, tubes of blood serum were inoculated with the mixture. It was found that cultures could be obtained under these circumstances, provided the temperature of the water was kept at or over 28° C. (2) By a similar procedure it was ascertained that no culture could be obtained, as long as the temperature was maintained at or below 11° C., even when dilution was represented by so low a figure as 50. Exposure for upwards of twenty minutes, however, was necessary to inhibit growth. (3) Pure cultures diluted with sterile water, and kept at 15° to 17° C., required exposure for six hours before they became inactive; indeed, in some instances, even that was not sufficient to destroy their powers of reproduction.

These experiments, it must be borne in mind, were made with pure cultures, whereas Piroinger's were made with pus. Again, in our case, proof of infectiveness was inferred from cultivation, whereas Piroinger made his tests by inoculation.

Be that as it may, the results obtained do not confirm Piroinger's conclusions, inasmuch as in the case of one specific organism at least which attacks the conjunctiva, mere dilution is not sufficient to destroy its vitality. On the other hand, they show that the essential factors in determining the action of dilution on the gonococcus are (a) temperature and (b) length of exposure.

It is quite possible that in some instances disease may spread, not so much through the water, as by means of infective particles that cling about the washing basin. In practice, however, it matters little which of the two methods come into play, and for present purposes it will be enough to show that the common use of water, or of washing basins, is a source of danger.

Gunning⁵⁰ points out that one of the chief reasons for the continued prevalence of trachoma among the Hebrew population of Amsterdam is connected with ceremonial ablutions. The women, it seems, periodically bathe in common tanks, plunging their heads beneath the water. As many of the bathers suffer from chronic ophthalmia, Gunning says that this religious observance becomes a frequent source of infection, contagious matter being conveyed by

the water from eye to eye. The towels, it should be observed, are used several times, so that there is a possible fallacy in that direction.

Marston⁶⁰ relates some interesting and fairly conclusive instances of the spread of the disease through the agency of water. The military prison, he tells us, was in a very crowded state, so that many of the men had to be confined in the cells at Upper St. Elmo. These prisoners, all of whom were attacked with ophthalmia, washed at two tubs, and the same water was used by as many as forty men. A private of the 15th regiment was the first to suffer from ophthalmia, and the soldiers afterwards affected had washed in the water used by that individual.

Marston's most conclusive case, however, is one which may be narrated in the author's own words:—"A married officer, holding an important staff appointment, and residing in one of the largest and best houses in Valletta, sent for me to see one of his children suffering from ophthalmia. I was surprised to find that the child had vesicular lids, and still more so when I discovered that nearly the whole family had indubitably vesicular lids, mostly in a latent stage. The English nurse was affected, also the baby. I next discovered that a native wet-nurse had lids advanced to a chronic and confirmed stage of the disorder; the baby slept with her. The children were frequently all bathed in the same water. An officer of the same department, who had arrived but a few days at the station, was temporarily put up in the quarters of this affected family. His nurse and child occupied the same day-nursery, but slept in a separate room and used separate washing utensils. They were perfectly free from the disorder. These facts leave no doubt in my mind that the native wet-nurse's lids were the *focus of origin and attack* in the house."

The only ambiguity in the foregoing case lies in the use of the term "vesicular lids." If by that expression Marston meant the contagious affection known nowadays as trachoma, there can be no doubt that the interpretation he placed upon the facts was the correct one.

A. Leith Adams⁶¹ has published some analogous cases, of

which the following may be quoted:—“One company of the 22nd Regiment was quartered, in 1864, in huts in an outwork of Floriana, Malta; there was no ablution room, and the only water supply was procured in buckets from a cistern distant about 200 yards in the ditch below. Now in this company there was a man who had suffered from granular lids, which were still discharging scantily with the mucous membrane in that thickened and abnormal state which may last for months or years after the disease has to all outward appearances been cured. In the course of a few weeks afterwards, several cases of granular disease occurring among the men necessitated a careful inquiry into the probable cause or causes, when, in addition to what has been stated, it was shown that there had been a custom at early or rouse parades, in order to get through the morning ablution with dispatch, for sometimes six or eight men to wash in the same water, and to dry their faces with each others’ towels.” Adams adds, “I have numerous other examples tending towards a probability that ophthalmia is frequently communicated among soldiers in this way.”

Writing of military ophthalmia, Parkes²²⁴ cites the following instance as showing that disease may be spread by imperfect washing arrangements: “In 1842 and 1843 I witnessed, in a regiment newly landed in India from England, a very great number of cases of this kind; the supply of water was very insufficient, many men used the same basins, which were very imperfectly cleaned; the same basins were used for washing, and also for dyeing clothes; at that time the men in the cold months wore trousers of a black drill, and when the dye came off they were accustomed to rudely replace it; they themselves ascribed the very prevalent ophthalmia to the irritating effect of the particles of the dye left in the basins, and getting into their eyes. There were enormous granulations on both upper and lower lids, and the disease was believed to be communicable.”

It scarcely admits of doubt that the malady described by Parkes was trachoma, and, further, that it was disseminated by common washing. The dye, probably, had little, if anything, to do with the matter.

Nesbitt,⁶⁰ surgeon to the convict prison at Gibraltar—where

trachoma was at one time endemic—related this suggestive case:— Among the prisoners in a certain ward, one man alone remained free from the disorder, and upon inquiry, he was found to be a cleanly individual, who never washed in the dormitory, but waited until he could obtain an abundant supply of water elsewhere. In the first place, the contagion was introduced into the prison by a Spaniard, and was subsequently spread by means of a common washing trough.

My own experience has furnished a number of instances where it was highly probable that ophthalmia was spread by water. Two such cases may be related, of which the first occurred some years ago under the following circumstances. Two patients lay in the same ward, the one with purulent ophthalmia, while the other was awaiting operation for squint. The latter developed the disease, and it was then discovered that both had washed, on more than one occasion, in the same bowl of water, although separate towels had been used. In this instance, the water seemed to have served as the medium for contagion: ophthalmia was the antecedent, ophthalmia the consequent.

The facts of the second case may be thus briefly stated. A number of children occupied a detached building, which was divided into two portions (A and B), each with separate washing, sleeping, and day-room accommodation. Portion A was tenanted by patients convalescent from ophthalmia, while B contained cases of the acute disease. The two groups of children were kept wholly apart, but, nevertheless, acute ophthalmia broke out among the inmates of section A, and attacked, in the first instance, two patients, who were subsequently ascertained to have stolen round, and used the lavatory belonging to the other side. According to the statements of the two children, they had dried their faces with their own towels, which, with curious perversity, they had carried with them on the occasion of their visit.

It may be objected that the disease which attacked the inmates of section A was the result of relapse, and had nothing to do with re-infection. While admitting that such may have possibly been the case, I cannot fail to regard the coincidence I have related as both

striking and suggestive. Indeed, it almost looks as though the children, in their mischief, had unconsciously planned the details of a roughly conditioned scientific experiment.

In the last instance I shall mention it is difficult to say whether water or towels or both were at fault. The facts of the case are as follows. Towards the end of 1893 my advice was sought concerning an epidemic of ophthalmia among the inmates of a provincial school. The disease, of muco-purulent type, was practically confined to the girls and infants, who washed in common at an insufficient number of fixed basins. The boys, who were lodged in another part of the establishment, had their own lavatory. They suffered little, and that not until late in the history of the outbreak. Inquiry elicited the fact that, in the first instance, the malady had been brought into the school by an infant, and I feel confident that it was afterwards spread among the other girls and infants by means of the imperfect lavatory arrangements.

A consideration of the foregoing facts can scarcely fail to convince the impartial reader that ophthalmia has been often spread by the common use of water, bowls, sponges, towels, and similar articles. I may add my personal conviction that faulty washing arrangements form the usual means by which the ailment is disseminated amongst communities of individuals.

2. *Hands and fingers.*—That ophthalmia may be passed by dirty fingers is a proposition that cannot be seriously disputed. Ware⁷ has related the history of two female children suffering from a purulent vaginal discharge. The surgeon who attended the family recommended the injection of a “vitriolic lotion”—an operation that was carried out by the mother. Some few days afterwards, the mother was attacked with an inflammation of the right eye, accompanied by a profuse purulent secretion. In her case, imperfectly cleansed fingers seem to have been the means whereby the eye became infected. Wardrop published an account of a young gentleman, labouring under specific urethritis, who touched his eyes with contaminated fingers. That occurrence was soon followed by a violent ophthalmia, which ended in suppuration and collapse of

both globes. Cunier²²³ recorded the fact that he had seen twenty-two men with gonorrhœal ophthalmia, all of whom had contracted that malady by touching the eyes with uncleansed fingers. There are many similar instances scattered through the literature of the disease.

Persons engaged in washing soiled linen have contracted purulent ophthalmia. Bacot⁶² mentioned two such cases, Benedict one, while Cunier had as many as four, and I have myself seen one. The virus was probably carried to the eye by means of the fingers.

It is an old observation that ophthalmia may be met with in female children who are suffering at the time from a vulvo-vaginal discharge. Many years ago Schmidt pointed out that the last-named condition was common in cases of ophthalmia neonatorum. In 1853, Roosbroeck⁵ wrote as follows:—"Among little girls one often sees vaginal discharge, now mucous, now purulent, occasioned by the presence of worms in the intestines, or by the disappearance of some scrofulous eruption. When the discharge is purulent, if the children have the ill-luck to transport to the eyes a particle of muco-pus furnished by the vaginal membrane, they soon become affected with a violent ophthalmia, which is capable, in its turn, of infecting a whole family." Jüngken^{63, 200} (1834) mentioned a case in which an infant with this so-called leucorrhœal ophthalmia infected seven other persons of the same family. Mackenzie⁴⁴ (1854) noted the connection, and distinguished between a mild and a severe form of ophthalmia. Among more modern writers, Jacob,¹¹⁹ Von Arlt, Widmark, Terson,⁶⁴ Fuchs, and Morax have noted the association.

It is a rule at the Ophthalmic School for a nurse to inspect female children under seven years of age, in order to ascertain whether vulvo-vaginal discharge be present. In older girls, such a condition would hardly escape notice, even in the absence of a special examination. Such discharges, according to our experience, are by no means common. Two varieties, however, have been noted, the one sharply defined from the other (*a*) by the presence and (*b*) by the absence of the gonococcus. The former I have observed exclusively in association with purulent ophthalmia, the latter with a mild kind of inflammation, much resembling ordinary

catarrhal ophthalmia. From our present standpoint, the main interest of these conditions lies in the fact that the patient's fingers are probably the medium by which eyes are infected from genitals, and *vice versa*.

Among collections of young children it is probable that disease is often spread by a child who, having contracted a contagious eye disorder, brings his soiled fingers into contact with the eyes of his healthy playmates.

It is likely that the most usual way in which nurses get ophthalmia is by carrying the contagion to their own eyes on infected fingers. That, however, is by no means the whole of the mischief; for the dirty fingers of a nurse (or surgeon) may convey ophthalmia to other people. The following case came under my notice some little time ago. A particular room contained twenty-five convalescent patients, together with one who had recently suffered from catarrhal ophthalmia. During three successive days, patient after patient was attacked with that disorder. The only explanation that I could offer was that infection had been spread by a recently appointed nurse, who had not acquired the experience necessary to avoid such an unfortunate accident. That view was supported by the fact that the outbreak ceased when the ward was put under the charge of a thoroughly trained and careful nurse.

3. *Handkerchiefs*.—Tourdes⁶⁵ has related an instructive example of disease communicated by means of a handkerchief, that occurred during an outbreak of ophthalmia in the Strasburg Civil Hospital. It appears that one of the affected children had been visited by his mother, who took the disorder herself. She had been observed to wipe her eyes with a handkerchief that had been previously used to those of her child. Gosselin¹³⁸ has described an analogous case.

In patients awaiting examination before admission to the Ophthalmic School, I have not infrequently seen a girl take her handkerchief from her pocket, and with it remove the discharge that had lodged on an infant's face. Among children, moreover, a handkerchief is often regarded as common property, and it may in that way be the means of conveying contagion from eye to eye. I am not in a

position, it is true, to adduce direct proof of such an occurrence, but in all probability it must often have taken place.

4. *Bed linen and body apparel.*—Sheets, blankets, counterpanes, pillow slips, and similar articles would be likely enough to pass on disease if used in common by the sick and healthy, and it can scarcely be doubted that such a mode of transference often occurred in parochial schools when “double beds” were in vogue. Numerous instances have been recorded where disease has been spread by sleeping more than one in a bed. Edmonston⁹⁷ (1802), in describing the ophthalmia which attacked the 2nd regiment of the Argyleshire Fencibles, wrote as follows:—“Men in perfect health, sleeping in the same bed with others under the influence of the disease, were generally affected in a similar manner the next morning.” Lawrence,⁴² Hall,¹⁹⁸ and Bader,²⁵⁴ have each related a case in which a patient probably contracted purulent ophthalmia by sleeping with a person who suffered from specific urethritis. Dr. Cooinch,⁶⁶ of Amsterdam, has made the significant statement that trachoma is much more frequent in married than in unmarried women of similar age. The following instance, which fell under my personal cognisance, forms fairly good evidence that ophthalmia may be spread by bedding. A child (B.D.) was seized with symptoms of acute muco-purulent conjunctivitis, and removed to a ward set apart for cases of the kind. Her place was taken by a convalescent patient (from another dormitory), who was attacked, however, within thirty-six hours by a similar ailment. It was found that, owing to a regrettable misunderstanding, the pillow and bed slept upon by B.D. had been used for the second child without having been disinfected.

5. *Animals.*—It is important to bear in mind that animals—as dogs, cats, and horses—may be the originators as well as the carriers of contagion. In a well known case, published by Decondé, a lad took ophthalmia from an infected dog, in whose kennel he had been shut up by way of punishment. Grossmann⁶⁷ was consulted by a gentleman with purulent ophthalmia, who had been licked on his face by his dog, which was at the time affected with gonorrhœa. Boucher⁶⁸ related the case of a soldier employed in the

veterinary department, who received a splash of secretion in the right eye whilst engaged in dressing a horse that suffered from *jettage muco-purulent*—i.e., nasal glanders. Although the eye was at once freely doused with water, purulent ophthalmia nevertheless quickly supervened. Gorecki⁶⁹ knew a case in which two little girls took the disease from a puppy that had ophthalmia. In describing an epidemic of “pink-eye,” Webster Fox⁷⁰ narrated the following cases, which may be given in his own words:—“A coachman was recently under my care who traced his attack to a horse that he was attending suffering with pink-eye. Several members of this man’s family contracted the disease. Another family traced the source of their trouble to a favourite dog suffering with “bleared eyes,” not noticed by the parents until their attention was called to the fact by myself. Another patient declared that his eye trouble developed in about ten hours after a piece of mucus was blown into his eye by the snorting of a horse that he was leading by the bit, this animal having a slight discharge from his eyes and nostrils at the time.”

Abadie²⁴⁷ has given an instructive account of a serious epidemic of conjunctivitis that affected, within a few days, 80 per cent. of the children belonging to the Vaucluse Asylum. According to his description, the malady was neither purulent nor trachomatous in character, but possessed peculiar features of its own. He traced its origin to the emanations from a neighbouring building, which sheltered a number of pigs suffering from “rouget.” *

Parinaud²⁴⁸ and Pierre Sans²⁴⁹ have described independently a series of cases, which they believe to proceed from an animal contagion. The ailment is characterised by large palpebral granulations, is unilateral, and always involves the preauricular, the parotid, and the neighbouring glands. A muco-purulent discharge, often blood-tinged, is a constant feature of the disease. It mainly attacks

* Rouget, it may be explained, is a contagious disease of swine, marked by fever, redness of the skin, paresis of the posterior extremities, and diarrhoea. It is also known under the names of rothlauf, red soldier, pig typhoid, swine plague, and hog cholera.

stablemen, butchers, curriers, veterinary surgeons, in short, those who have to do with animals; and although it may last for several months, it nevertheless gets well eventually without leaving any traces of mischief in the conjunctiva. Speville²⁵⁵ has reported two instances of this curious ailment. His first patient had been exposed to the emanations from a dung-heap, while his second lived over a room inhabited by a pork-butcher.

Sir Patrick MacGregor⁴⁷ was one of the first to insist that flies may transport infectious matter from eye to eye. After pointing out that contagion is less active in cold than in warm weather, he went on to say that, under the latter circumstances, flies might be seen surrounding ophthalmic patients, and he believed that the malady was often communicated by those insects. Bountah,⁷² of Cairo, held a similar opinion. Anagnostakis,⁷³ too, believed that flies were largely instrumental in passing on the virus. Decondé gave an account of "granulations" set up by the entrance of a fly into a man's eye. Howe,⁷¹ also, was of opinion that propagation was largely due to the common house fly. He remarked that in Egypt epidemic ophthalmia was at its height when flies appeared, while it diminished as they grew less numerous; further, that actual cases of disease thus communicated were on record. Moreover, he succeeded in getting cultures of micro-organisms by allowing flies to crawl across a plate of nutrient gelatine, and found that they agreed in character with those obtained direct from an eye with ophthalmia. Litteljohn,⁷⁴ describing one of the earlier outbreaks at Hanwell, painted a graphic picture of a lad, whose eyes were so bad that he was surrounded by swarms of flies, which had to be kept away from him and from his fellows by muslin veils. G. A. Berry⁷⁵ has recorded two cases in which diphtheritic ophthalmia was probably set up by flies. In the first, inflammation came on within twenty-four hours after the patient had been stung in the eye by an insect that had just arisen from a dunghill. In the second, a fly got into a student's eye, and it was found that there was, at or about the time, diphtheria in the immediate neighbourhood. Sir William Moore,⁷⁶ in the course of an interesting article on "Flies and Disease," has observed:—

“Every traveller in the East must have seen people walking or sitting about with inflamed eyes, not even troubling to brush the flies away that swarm around their eyes. This is especially the case with children. Eyes, whether diseased or healthy, being particularly attractive to flies, the conveyance of ophthalmia from one person to another by these insects cannot be denied.” Much the same thing has been said by Demetriadès²²¹ (of Alexandria) in a recent communication. “Flies,” he wrote, “are a veritable scourge in Egypt; their appearance always coincides with the commencement of epidemic ophthalmia, and when they are most numerous (at the rise of the Nile) purulent ophthalmia is also at its maximum. The disease does not diminish until the end of October—after the first rains, which make the flies disappear. . . . In summer, during widespread epidemics, infants one to five years of age are specially prone to infection, because children of that age do not understand how to protect themselves against the flies.” As the outcome of an investigation that he has lately undertaken, Fuchs²⁵⁶ endorses this view. He is of opinion that ophthalmia is disseminated in Egypt mainly by these insects. Lastly, it may be noted that Mr. Jonathan Hutchinson⁷⁷ has recently expressed his belief that flies are the chief agents in the spread of school ophthalmia.

From what has gone before, then, we may fairly conclude, (1) that purulent ophthalmia may originate from dogs or horses with a specific discharge, either from the eyes or elsewhere; (2) that flies and other insects are capable of conveying the virus of disease to healthy eyes.

6. *Miscellaneous Agents.*—A remarkable case has been recorded by Brière.⁷⁸ A child was born with a small nævus of the eyelid, which a woman promised to cure by friction. She accordingly rubbed the growth with a fragment of placenta obtained from a female of doubtful character. Three days later, the eye showed all the signs of purulent ophthalmia. Hirschberg²⁴⁶ had a patient who contracted purulent ophthalmia through bathing her eyelids with camomile tea. It was found that the fomentation had been previously used for her grandchild, who was suffering from a similar ailment.

Leaving on one side such extraordinary cases, the disease, speaking generally, may be communicated by any article that is capable of being touched or used in common by sick and by healthy persons. Toys, for example, would be a likely means of conveying the germs of disease, together with such objects as furniture, door-handles, books, brushes, combs, spoons, forks, cups, dressings, utensils, syringes, shades, and protective goggles. With regard to spectacle-frames, Mittendorf⁷⁹ mentions several cases where trachoma has been contracted in that way. Personally, I have known disease spread by the indiscriminate use of a pipette. Sir William Adams¹¹⁸ contracted ophthalmia by touching his own eye with an instrument that had been employed in the examination of a patient with the disorder. It may be broadly stated that the more absorbent the surface of any particular object, the more likely will it be to convey infection.

In summing up this discussion, then, we may say that the different varieties of contagious ophthalmia are spread almost always, if not altogether, by contact. We must take care, therefore, that patients are provided with beds, clothes, towels, sponges, flannels, and washing utensils of their own, and that they are not permitted to mix with unaffected persons. Nurses and those employed about the sick must be told plainly of the nature of the ailment they are tending and of its modes of transfer. They must be made to keep their nails pared close and their hands scrupulously clean, and they must never take an infected child into their arms if it can possibly be avoided. Great care must also be expended to ensure the absolute cleanliness of all instruments and ward appliances.

The assumed miasmatic origin of the contagious eye affections in general, and of trachoma in particular, has dominated the views of many acute observers. That theory, which cannot be upheld in the light of present knowledge, has done more to obscure the true issues than any other view with which I am acquainted. It has diverted attention from the fundamental fact that underlies all successful treatment, namely—a rigid separation of the sick from the healthy. It

cannot be too often repeated that, with one doubtful exception, these different ailments originate in contagion from pre-existing cases.

In concluding this part of the subject, it may be pointed out that although ophthalmia is spread mainly, if not entirely, by contagion, yet it is in many instances impossible to follow the steps of that process. This is especially the case during widespread outbreaks, where so many factors come into play that the actual passage of disease from one person to another can rarely be traced. Nearly the whole of the evidence in favour of aerial infection has been collected during times when ophthalmia has been epidemic, and to that extent is open to many sources of error. A better chance of getting at the root of the matter is afforded by the study of sporadic cases, in which a clear history of contagion may not infrequently be made out.

The inflammatory changes resulting from specific inoculation stand in close relation to the quantity and strength of the virus, on the one hand, and to the resisting powers of the conjunctiva, on the other. Fresh secretion, for instance, will act more speedily than that which is older ; pus taken from a virulent blennorrhœa will, other things being equal, cause a more severe inflammation than matter derived from a milder case. A conjunctiva that has been damaged by former inflammation, or one that is at the moment of inoculation in a condition of chronic hyperæmia, will be less resistant to infection and will suffer more intensely than a healthy membrane.

It must not be thought, however, that every eye into which the seeds of contagion may fall will become infected with ophthalmia. In that disease, as in many others, there seems to be such a thing as personal immunity. We are not in a position to explain how this comes about, although it is presumably connected with varying qualities of protection possessed by the epithelial coating of the conjunctiva or by its adenoid coat. The fact remains that some individuals appear to be practically insusceptible as regards ophthalmic virus.

The seasonal and climatic variations of ophthalmia, although of great interest, need not detain us in this place.

The ground has now been thoroughly opened up, and definite

opinions have been declared, not only as to the diagnosis, but also as to the modes in which epidemic eye maladies originate and pass from the sick to the healthy. We may next proceed to consider what is, perhaps, the most practical part of the subject, viz.—THE MANAGEMENT OF EPIDEMIC OPHTHALMIA.

When consulted about an outbreak of ophthalmia in any institution, a surgeon's first duty will be to make a systematic examination of all the inmates. He should evert the lids fully, making notes as to the actual condition of every eye he looks at. He should also examine the officers and servants of the institution, particularly those who come into close relationship with the children. His next proceeding should be to enquire into the history of the epidemic; as to the part of the building in which the first cases were observed; and as to the way in which the disorder spread. It will be advisable for him to see and to question those individuals who may be reasonably supposed to possess material information. If the institution have its own medical attendant, resident or otherwise, his inquiries should be directed to that gentleman; otherwise, he should apply to the headmaster, governor, superintendent, matron, or other responsible official.

The surgeon should next turn his attention to all points bearing upon the spread of ophthalmia. He would, for instance, enquire into the arrangements for washing and for bathing, and make a point of seeing for himself the conditions under which they were carried out. Special attention would be paid to towels and other articles of the kind. The surgeon should then inspect the whole of the premises, so as to ascertain whether the inmates have a sufficient allowance of superficial space, not only in their sleeping, but also in their school and recreation rooms. He would at the same time note whether those apartments were efficiently ventilated and heated. He should enquire into the sanitary arrangements generally, and find out whether they are constructed upon a modern and approved plan. The dietary should be taken into consideration. In a word, he must acquaint himself with the conditions of life and surroundings of the population he has to deal with. Lastly, he should ascertain what steps were

taken to exclude applicants for admission whose eyes were already diseased.

A great deal of information will now lie at his disposal, which must be arranged and tabulated in such a way that a clear and comprehensive view may be taken of the entire situation. His further proceedings will, of course, be guided by many considerations, as for example, the nature of the epidemic, the number of those affected, and the kind of institution.

The following remarks will refer chiefly, if not altogether, to parochial and other schools.

In former days it was not uncommon to break up regiments in which ophthalmia had made its appearance. This practice was at one period extensively pursued in the Belgian army with disastrous consequences. Ophthalmia spread to the families of discharged soldiers, and in this way numerous fresh centres of contagion were scattered throughout the length and breadth of Belgium. According to Bendz, the disease was spread amongst the civil population of Copenhagen by the dismissal of imperfectly cured soldiers.

A similar dissemination of the malady would almost certainly result if a number of infected scholars were sent home to their parents. The proper way would clearly be for the school authorities to provide suitable means for isolation and treatment. If parents or guardians insisted upon removing their children, it should be upon their own responsibility, after they had been made fully acquainted with the dangerous nature of such a proceeding.

The case is obviously different as regards those whose eyes are free from any trace of disease. No law can prevent parents from taking such children away from a dangerous centre of contagion. Indeed, a step of this kind may often be advisable, since the removal of healthy lads will leave the school authorities a freer hand in dealing with the outbreak. Under some circumstances, therefore, it will be the surgeon's duty to advise that all those who have not taken the disease should be sent home forthwith.

That isolation forms the first and most vital point in the preventive treatment of ophthalmia is shown by the history of many

epidemics. The outbreak in the Chelsea Military Asylum,⁴⁷ for instance, raged for six years, and affected many children. To cope with it, various means were devised, in all of which the separation of the sick from the healthy was imperfectly carried out. It was finally put an end to by housing the whole of the patients in a detached building some distance from the asylum. Again, in the year 1873, all cases of ophthalmia in the Anerley Schools were drafted away to a newly erected but unoccupied workhouse. The separation was complete, and the results obtained were correspondingly good. The Brentwood District School, at that time belonging to Hackney and to Shoreditch, adopted a similar policy in 1882, when about ninety ophthalmic patients were sent to a small, separate establishment at Harold Court, some three miles away. Isolation was kept up for two years—in fact, until the parishes named dissolved partnership. A serious epidemic occurred in the Lambeth Old School, at Norwood, during the months of June, July, and August, 1886. It followed an outbreak of measles, and reached its culminating point upon the 28th of the last named month, when 55 per cent. of the total school-population were labouring under the disease. The guardians became alarmed, and adopted the mistaken policy of sending all the cases to the Parochial Infirmary, which lay in the heart of London, and which had never been designed for such a purpose. Under the circumstances, proper isolation was out of the question. What was the result? The malady increased in virulence, and a certain number of eyes were seriously damaged, if not actually lost. It spread to children who had never been to the schools; it attacked nurses and other officials employed about the patients; and the administration of a large and important infirmary was entirely upset. To shorten the story, the epidemic was at length subdued by sending the patients back to Norwood, where they were housed in a building cut off from the rest of the school premises. The history of the Central London District School, at Hanwell, is another case in point. Ophthalmia had been endemic in that institution since it was first occupied in 1859. The disease, it is true, varied in severity at different periods, but in one form or another it was never absent from the school.

During thirteen years, an average of 207 cases of ophthalmia occurred annually needing isolation. Over and over again the advice of experts was sought as to the best means of stamping out the disease. It was not, however, until the year 1889 that stringent and systematic measures were adopted. At that time, about 33 per cent. of the inmates were affected, and the condition of the school attracted a considerable share of public attention. Questions were addressed to the responsible Minister in the House of Commons, and the need of energetic action was urged upon the school managers. Accordingly, a detached hospital, capable of accommodating 400 patients, was erected, and every affected child at once isolated. The consequence was that by June, 1893, the proportion of ophthalmic patients sank to 7 per cent. of the school population, while two years later it stood at '5 per cent.

There would be little difficulty in multiplying examples such as the foregoing. But enough has been said to show that the eradication of ophthalmia centres upon rigid isolation, which is, indeed, the keystone of preventive treatment in all infectious diseases. All other measures, however useful and desirable, are subordinate to the absolute separation of the sick from the healthy.

In coping with an epidemic of ophthalmia, therefore, the first step is to remove all those who are suffering from the disease. Half measures are worse than useless: there must be complete and permanent isolation. To attain that end, it may be sometimes advisable to move the patients into another locality, perhaps many miles from the place where the epidemic first arose. This is especially the case when trachoma lies at the root of the mischief, and many children are affected. On the other hand, if the outbreak be merely one of catarrhal ophthalmia, it may then be possible to set aside some detached portion of the school premises, in which efficient isolation can be carried out. The ordinary sick-room—often merely an apartment in the school-house or in one of the masters' residences—is ill adapted for such a purpose, and ought never to be used. In a high-class school the ordinary sanatorium or infirmary, provided it stands in its own grounds, may be available.

As an alternative, one or more of the masters' houses might be used for the time being to shelter ophthalmic patients, although that would be possible only when the houses stood away from one another and from the school building.

If comparatively few children were affected, it might be feasible to lodge them in a farm-house, or even in a series of cottages some distance away from the school. In a good class boarding school, where ophthalmia was rife, some thirty of the affected lads were recently sent to a Scarborough hotel, specially retained for their use (Snell⁸⁴).

In case of need, huts of galvanised iron, wood, oiled canvas on wooden frames, or of the so-called Willesden paper might be quickly run up. In summer, at any rate, supplementary accommodation could be secured by tents pitched upon a wooden or asphalt flooring. At the St. Petersburg Military Hospital—where numerous cases of purulent ophthalmia were quartered between the years 1835 and 1839—convalescent patients were placed in tents during the summer months. Florio,²⁴³ the oculist in charge, claimed that this was one of the most certain means of getting rid of granulations, of strengthening the sight, and of preventing relapses. In 1872, an outbreak of purulent ophthalmia among the inmates of the St. Stanislaus Asylum, at Nancy, was overcome in this way, all those affected being lodged, according to Parisot,¹³⁷ in tents and marquees.

Should an outbreak occur in several schools controlled by a central authority, the best way of securing trustworthy isolation would be by setting apart one school for the use of patients. Dastot tells us that such a course was followed in 1878 at Mons, where granular ophthalmia was found to prevail extensively among the scholars of the communal and primary schools of the town.

The aim in all cases must be to secure complete isolation, and to that end it is advisable to place the wards under a separate administrative control. A medical man or a skilled and capable matron should be at the head of affairs. The hospital nurses and

servants ought to have no duties whatever in the main school-buildings. For a similar reason, special cooking, laundry, and other arrangements should be provided, whenever possible.

The wards should be arranged so as to contain some provision for the treatment of sickness, which is, of course, liable to arise at any moment among the ophthalmic patients. As far as my experience goes, the latter enjoy good general health, so that sick accommodation equal to about 6 per cent. of the total number isolated would be ample. As regards parochial schools, however, in addition to the foregoing, separate sleeping and washing arrangements must be provided for ringworm cases. Such children may be allowed to go to school with the other inmates, provided proper measures are taken to prevent the *tinea* from spreading. Lastly, it is desirable to have special accommodation for measles, hooping-cough, scarlet fever, and other zymotic diseases. Hence, whenever possible, one or more rooms, widely separated from the rest of the premises, should be set aside for that purpose.

The first question will be with regard to the cases that should be separated, a point which is by no means easy to decide. It goes without saying that every child who shows signs of acute ophthalmia should be kept apart, while a similar remark applies to sufferers from chronic trachoma. The difficulty lies with follicular conjunctivitis, and the surgeon's action must necessarily be guided by his views upon the nature of that affection. From my own standpoint, which has been clearly outlined in an earlier part of this monograph, folliculosis is not a serious condition. It is neither contagious, nor does it constitute an early stage of trachoma. Left to itself, it is likely to do no harm either to the child affected or to those near him. Personally, therefore, I fail to see any necessity for isolating such patients. The presence of these little follicular outgrowths I regard merely as indicating the necessity for a good sanitary environment. At the same time, I should certainly treat such cases if they showed any discharge; and if the latter were muco-purulent or considerable in quantity, I might even resort to isolation. In order to decide these points, it is a good plan for the medical

attendant to inspect the eyes of all children early in the morning, before they have been allowed to wash, so that any matter may be easily detected. When in doubt, it is, of course, a wholesome rule to separate a child, rather than to run any risk by leaving him to go about loose in a school. Blepharitis, phlyctenular affections, and other conditions not usually regarded as being contagious, may be treated as out-patients. The policy, however, of attempting to treat chronic trachoma without isolation is, in my opinion, a fatal one, and has not infrequently led to an extension of that ailment among the healthy children of a school. Such cases are better removed, not only for preventive purposes, but also because they demand special treatment, nursing, and education.

It is of importance that steps be taken to continue the education of ophthalmia patients. In the acute disease that cannot, of course, be done, but in the majority of chronic cases, it may proceed almost as if the children were well. The experience of the Ophthalmic School shows that 91 per cent. of such patients can attend school regularly, provided, at the same time, treatment of the eyes be persevered in. The disease is thus rendered quiescent, with the result that education and medical treatment are enabled to go on side by side. The bulk of these children, it should be remembered, are not confined to bed. They are up and about, and full of a mischief that may be intensified by an idle and aimless life. At the Ophthalmic School patients receive twenty-three hours schooling per week. They are examined annually by H. M. Inspector, and at his last visit the boys obtained about 90 per cent. of passes. To condemn such children to the dull routine of infirmary life is to do them a serious injustice. In short, the education of patients should proceed much as though they were not the subjects of a tedious and contagious complaint. The purely verbal instructions recommended by some authorities is unnecessary. It need hardly be added that the medical attendant must be the sole judge as to the amount and kind of schooling in any particular case, and that the whole of the educational arrangements should be under his control.

The systematic treatment of the sick forms an indispensable

adjunct to isolation, and will be found fully described in another portion of this book.

Nursing, another point of vital importance, must be organised and controlled by the medical officer. In this place it need only be pointed out that for acute ophthalmia both day and night nurses will be required, and that under no circumstances ought one attendant to have charge of more than ten such patients at one time.

With regard to the classification of cases much must obviously depend upon the nature and extent of the available accommodation. Thus, the task will be easy if there be a number of small rooms at command, and just as difficult if there be two or three large dormitories only.

Should an epidemic of diphtheritic inflammation occur, it would be necessary to separate instantly all those infected from the rest of the ophthalmic patients. Isolation in such a case would have to be absolute, not only for the diphtheritic patients, but also for those in charge of them. In fact, all precautions enforced in zymotic diseases generally must be carried out most stringently in this particular instance.

In the case of other epidemic ophthalmiae, classification is just as needful. For example, mild cases should be separated from severe ones; convalescent patients should be kept apart from those who still show signs of acute disease, inasmuch as there is reason to believe that so-called relapses often mean nothing more than re-infection. In trachoma, acute must be classed separately from chronic conditions; and special wards may be set aside for chronic cases that show a good deal of discharge, or that are known to relapse frequently. If children with follicular disease be isolated, they must under no circumstances associate with cases of acute ophthalmia; further, they should be kept apart from other ophthalmic patients, at any rate so far as sleeping and washing arrangements are concerned.

It is desirable to have a number of small wards, containing not more than 8 to 10 beds apiece, for the reception of patients who demand special nursing or complicated medical treatment.

One of the most responsible duties that can fall upon the medical

man is to decide when those who have suffered from ophthalmia are fit to leave the isolation wards. In order to settle this important point, he must be mainly guided (1) by the condition of the eye as to discharge, and (2) by the appearance of the conjunctiva.

Some curious plans are on record for ascertaining whether discharge is still present. For example, Hoor, in a recent publication,⁹³ recommends that a weak solution of zinc be dropped into the eye, so that any muco-pus may be floated out in the form of filaments or shreds. Such roundabout methods, however, are at the best unnecessary. All that is needful is to inspect the patient early in the morning, that is to say, before he has washed. In that way the slightest trace of discharge will be detected. At the Ophthalmic School we employ the terms "*no discharge*," "*very slight*," "*slight*," "*moderate*," and "*profuse discharge*," to each of which a definite meaning is attached. An entry is made daily about each child, so that his record as to discharge may be quickly run over. The practical outcome of all this is, that no patient should be dismissed until he has been free from morbid secretion for at least a month. The only exception to this rule is in the case of chronic trachoma, which, even when perfectly quiet, sometimes continues to secrete a little watery mucus for an indefinite period.

Theoretically, no patient should be sent away until the palpebral conjunctiva has become smooth, thin, and free from redness, but, practically, that state of affairs is seldom attained, except, perhaps, after catarrhal ophthalmia. After trachomatous, purulent, and diphtheritic inflammation the mucous membrane shows more or less organic change; or, in other words, it seldom, if ever, returns to its normal state. Its surface will remain scarred, reddened, and thickened, either wholly or in part. To put the matter in another way, there is no standard of recovery to which every diseased conjunctiva can be brought by treatment; each case, therefore, must be judged upon its merits. It can scarcely be repeated too often that the only trustworthy test of quiescence is patient clinical observation. Full particulars upon this point are given in a later section of the book,

and the remarks made in that place upon trachoma apply equally to the other affections with which we are concerned.

In parochial schools it is a common occurrence for children, whose cure is only partially complete, to be sent for by their parents. As the law stands at present, the medical officer appears to have no power to prevent the discharge of such patients, notwithstanding the fact that to let them go is plainly opposed to the public interest. Under the circumstances, his best plan will be to notify those responsible for the child that the latter has been under treatment for a contagious eye malady, and that further medical attention is necessary. In the case of large towns it might be advisable to supply the names and positions of the chief ophthalmic hospitals, so that there might be no excuse for not placing the child under prompt and skilled treatment.*

We will now suppose that the surgeon has not only familiarised himself with the ophthalmic condition of every inmate, but that he has also effected a complete separation of the sick from the healthy; that the ophthalmia patients, moreover, have been housed in a building, or series of buildings, structurally fitted for the reception of such cases; and, lastly, that they have been provided with proper medical and nursing attention.

The next point of enquiry will be directed to the conditions under which children are admitted to the institution. In this respect there is, of course, a radical difference between individual schools. For example, in reformatories, and in truant, industrial, and parochial schools admissions often take place at intervals of a few days. In public schools, on the other hand, pupils are received at the beginning of each term, that is to say, three or four times during the course of the year. To vary the statement, while

* The importance of taking steps of this kind will be shown by the following extract from an account given by Lloyd⁹⁴ of an outbreak of epidemic ophthalmia at Christ's Hospital, London, in the earlier years of the present century. "It so happened," he wrote, "that several of the boys were permitted to go home for the benefit of their general health before they had quite got rid of the disease, which some of them therefore communicated to their friends, and among the individuals thus affected it came to my knowledge that several cases of total and permanent loss of sight in one or both eyes occurred."

the population of a good class boarding school is practically stationary, that of the other institutions named is in the highest degree fluctuating. These opposite conditions demand a corresponding difference in the medical supervision of the two classes.

The importance of examining the eyes of all newcomers lies in the fact that many epidemics have been definitely traced to a contagious case that has slipped into a school unawares. Turnbull⁸⁵ has described an outbreak of ophthalmia in an orphan asylum which followed the reception of a "sore-eyed" child. Adolf Alt⁸⁶ mentions another case, which occurred at the German Protestant Asylum in 1885. An epidemic of trachoma, which affected about 68 per cent. of the inmates, followed the admission to the institution of a child who had that disease in an aggravated form. These instances (and others might be added) emphasise the paramount importance of examining all candidates for admission to a school.

In many public schools it is now customary for boys upon admission to bring with them a certificate signed by their parents or guardians. That document gives particulars as to past and present health; as to any ailment or constitutional peculiarity; and as to whether its bearer has been recently exposed to any infectious disorder. It might well include a distinct reference to the condition of the eyes, filled up by a medical man, and thus be of more practical value than at present appears to be the case.

The possession of a satisfactory medical certificate, however, would by no means absolve the school doctor from making an independent examination of the candidate. He is responsible to the governing body, or to the headmaster, for the well-being of the boys, and it is his duty to prevent, so far as he can, the introduction of any epidemic illness. He ought, therefore, to acquaint himself fully with the ophthalmic condition of every fresh arrival to the school, as well as of that of old boys returning after the vacation. The results of his examination should be recorded in such a way as to be available for future reference. It is difficult to over-estimate the importance of such records, which are demanded for general no less than for ophthalmic reasons.

In all institutions where admissions are frequent, it is wise to adopt the plan followed in the metropolitan pauper schools, viz., that of Probation, as it is called. The term over which this detention extends varies at the different institutions, but upon the average it covers thirteen clear days. During the whole of that time fresh admissions are lodged in their own quarters, and are thus kept wholly apart. A well arranged probationary system implies that the children are received at stated intervals, say, fourteen days apart. In the interval between admission days, children will accumulate (in the case of pauper schools) in the workhouse, where they should be kept separate from other inmates for obvious reasons. As soon as children reach the probation house, they should be medically examined as to the exact condition of their eyes, and the results entered in a book set aside for the purpose. If the lids are found to be unsound, the child should, if possible, be returned to the union from whence he was sent, or, failing that, be placed forthwith in the isolation wards. It need scarcely be added that another examination should be made before the child leaves the probation house for the main school.

Until an epidemic has been stayed, and all affected children safely isolated, it is often a good plan to suspend admissions.

One further point as to parochial schools, namely, a caution to the surgeon never to neglect to note the condition of any child who leaves the institution. Apart from the scientific interest attached to such an examination, the record may form valuable evidence at some future date.

It should be borne in mind that there is another way in which epidemic sickness may be sometimes imported into a school from the outside world. Day scholars, for example, have been known to introduce zymotic ailments ; visitors have left behind them the contagion of measles and like affections ; while boarders have come into contact with infected persons away from the premises, and have thus brought back the germs of disease. Although this mode of transference cannot be often concerned in ophthalmia, for reasons already stated, yet instances of the kind have been recorded. Thus, Hairion ³⁴ gave an account of a boarding school at Thildonck where ophthalmia raged

for fifteen months. It followed an outbreak of a similar affection in a neighbouring parish, and the presumption was that it gained admission to the school in some such indirect way. If ophthalmia, therefore, were present in any town or village near the institution, that place should be put "out of bounds," and boys should be prohibited from going there. For a similar reason, if the malady made its appearance in the family of any officer or servant of the school, notice of the fact should be at once given to the medical attendant, who should take such steps as might be deemed necessary to prevent the entrance of infection into the institution.

It need scarcely be pointed out that an official himself afflicted with trachoma (*or other contagious complaint*) should never be permitted to come into contact with healthy children.

In a school composed partly of boarders and partly of day scholars, the presence of the latter may call for special measures. Should an epidemic be in full swing, it will be advisable to suspend their attendance, until such time as the sick have been removed from the premises. Should a day boy contract ophthalmia, he ought, whenever possible, be sent to join the rest of the patients, and be kept with them until he has recovered.

The connection between pudendal discharges in little girls and ophthalmia has been already mentioned, but the point is so important that it will readily bear a further reference. The reason for this lies in the fact that a certain number of epidemics of ophthalmia have been definitely traced to leucorrhœal infection. One of the best recorded instances of the kind is that related by Davis.¹³⁹ A child, suffering from a copious vaginal discharge, was admitted to the Philadelphia Hospital in December 1870. About ten days afterwards she was found to have double purulent ophthalmia, a condition which spread rapidly, and ultimately affected no less than forty-five persons. There can be no doubt that the pudendal affection was the starting point of the epidemic, and Davis, in recounting the facts, adds an interesting note to the effect that "there was throughout no case that could not be traced directly to another previously diseased." Another instance of the same sort of

thing was published by Leszynsky.¹⁹⁷ A charitable institution contained 212 inmates, and out of that number 22 had purulent ophthalmia. Those first attacked suffered from a profuse leucorrhœa, and Leszynsky was of opinion "that the ophthalmia in these cases was caused by the direct contact of the pus from the vulva, the fingers of the child being the medium for conveyance." The practical conclusion is, that a school doctor should treat all vaginal discharges; and, further, that he should ascertain their presence or absence in cases of purulent ophthalmia for which no other cause can be made out.

The surgeon's next problem will be how to keep the children free from ophthalmia. He may deal with this under two heads, viz. :—(1) a careful observance of the laws of health, and (2) frequent medical inspections of all inmates.

It is a well-known fact that a defective sanitary environment has much to do with the spread of epidemic sickness in schools and similar places. As regards ophthalmia, such adverse conditions probably act in two ways. In the first place, they predispose to hyperæmia of the conjunctiva, which stands in close relationship to actual infection; that is to say, a reddened mucous membrane will be more likely to form a favourable nidus for the germs of disease than one that is pale. Secondly, they foster and spread contagious maladies by such glaring faults as defective ventilation, over-crowding in dormitories, and the indiscriminate use of washing utensils. Now, let a case of communicable eye disease run loose amid such surroundings, and its spread will be only a matter of time. On the other hand, an infectious ailment introduced into a wholesome and sanitary school will, to a great extent, fall on barren ground, and hence will find it difficult to get any foothold.

The following remarks must be taken as applying not only to the actual school, but equally to the masters' houses, where that system of lodging scholars is in vogue.

The schoolhouse, then, must satisfy the laws of a good hygiene. In its dormitories, for instance, at least 36 feet super. should be allotted to each inmate, and for infants, indeed, that amount may be

advantageously increased to 50 feet. As a general rule, moreover, a relatively greater amount of floor-space should be made for large than for small collections of children. A calculation based upon cubic space is misleading, especially when any height above ten feet is taken into account. In actual practice, therefore, it is better to be guided by floor-space alone.

If cubicles exist, special allowance must then be made for the impediment they offer to satisfactory ventilation. It is often advisable to abolish them altogether ; but, under any circumstances, the bottom of the partition between individual beds should stand a foot clear from the floor, while the screen itself ought not to exceed six feet in height.

No sleeping apartment that contains more than a few children can ever be thoroughly ventilated in the absence of cross windows ; that is, sashes in opposite external walls of the room. Tobin's tubes, Sheringham's valves, perforated air bricks, and kindred appliances are all very well in their way, and may be used to supplement but can never displace window ventilation. To my mind, cross ventilation is a first necessity in any ward intended for children. Nor is it altogether a question of air supply, since the more light that enters a room the better for the occupants. External windows admit an abundance of sun-light, now known to inhibit or destroy many disease germs. Light implies cleanliness, and cleanliness, health. A plentiful supply of fresh air and of sunlight is essential when dealing with collections of children who dwell under a common roof.

The whole of the rooms occupied by children ought to be properly heated. Ventilation and heating are inseparably bound up together, and one can hardly expect fresh air to be admitted freely to a ward in winter unless there be provision made for warming. Open fireplaces, stoves, hot water or steam pipes, therefore, should be provided in all parts of the building to which children have access, *e.g.*, dormitories, school-, class-, and play-rooms, studies, lavatories, dining halls, library, and chapel.

A good deal of evidence points to the conclusion that excessive

dampness of the air predisposes to external inflammations of the eye. On this account, dormitory floors ought not to be scrubbed ; and the scoured boards that appeal so strongly to a housewife should be unhesitatingly condemned by the medical man. Besides rendering the air damp, the process of washing entails other evil consequences. Thus, water charged with putrescible material gets beneath the flooring, where it gives off organic emanations under certain atmospheric conditions. These drawbacks may be, to some extent, avoided by using damp sawdust instead of the scrubbing brush. The only really satisfactory treatment, however, is to saturate the boards with linseed oil, and, after staining, to polish with beeswax and turpentine. In the case of old floors, before that is done, gaps between neighbouring planks should be caulked, and then sealed with marine glue or other suitable material.*

The dietary should be overhauled, not because badly cooked or imperfect food has been proved to be connected with ophthalmia, but because it may predispose to that ailment, as to any other, by lowering the general health. For a similar reason, attention should be bestowed upon the school drainage and water supply ; and closets, latrines, and so forth should satisfy a good modern standard.

Children should not be permitted to congregate together in large masses. Ample playground space ought to be provided, and every effort must be made to arouse a healthy interest in games and other outdoor pursuits. In the eloquent words of Dr. Bridges,⁸⁷ " Everything which promotes free circulation of atmosphere, which creates muscular and moral energy, which raises the boy or girl from a dead fraction to a living unit, will tend to eradicate not ophthalmia only but the other diseases of stagnation, physical and moral."

From what has gone before, the reader will have gathered that ophthalmia is often spread by imperfect lavatory arrangements. The conclusion is, that every precaution should be taken to eliminate

* A stained and polished floor cannot be recommended where there is much traffic, for example, in play- and in school-rooms. In those particular instances, a well-laid wooden parquet flooring, which is practically impervious to moisture, is the best substitute. It may be scoured with sawdust or cleansed with tea leaves sprinkled with carbolic lotion.

that common source of danger. Contagion may be conveyed in many ways, some of which are so obscure that the attempt to deal with them effectually seems almost hopeless. When we turn, however, to its transfer by faulty washing arrangements, we find ourselves on firmer ground. For example, we can prevent the use of the same towel by more than one person ; we can erect such an apparatus for washing and for bathing as to render the use of water by more than one individual a physical impossibility. The limits of the present paper will not permit a detailed description of these various contrivances, but the reader will find a full account of them in the Appendix. In this place I will merely add my personal conviction that a system of the kind is desirable for all communities of persons living together under a common roof.

In concluding this section it may be pointed out that clothes from an infected individual should never be washed with those belonging to healthy persons. If the isolation wards contain no separate laundry, everything that leaves a patient should be passed through a steam disinfector, or be effectually sterilised in some other way, before going to the general school laundry. A still better plan is to send the soiled linen—of course, after proper disinfection—to an outside contractor, with whom arrangements have been made. If this course be adopted, all articles from the ophthalmic patients should be washed separately from those belonging to other persons.

Handkerchiefs should be numbered and stitched to the clothing, so that they cannot be used by more than one child. As noted before, they are a likely medium for the spread of infection, and in very contagious cases are best done away with altogether, or replaced by sheets of specially prepared Chinese paper, which can be burned after use.

Every official should understand the importance of prompt notification of any red or discharging eye. If the medical attendant be not resident upon the premises, it is advisable to give some trustworthy person a general authority during his absence to place any suspicious case apart from others.

One of the best safeguards that a school can have with regard to

ophthalmia lies in frequent medical inspections. This point is so important that a few words may be devoted to it in this place.

The number of inspections and the interval between each will depend, of course, upon the nature and amount of disease. As a general rule, a thorough inspection once a month will suffice, whereas in epidemic periods it will be advisable to examine all children three times a week or even daily. In schools whose ophthalmic history is good, the examinations may be conducted at intervals of three months or so ; but under no circumstances should they be altogether neglected. They constitute an invaluable preventive measure, and many a disastrous outbreak of ophthalmia might have been obviated by their timely use.

In addition to the foregoing systematic examination, the surgeon may see the inmates, say, once or twice a week, in a more expeditious manner. He stations himself close beside the door of a room, while the children file rapidly by him in such a way that a good light falls on every face. By this means, any discharge, redness, or external change can be at once observed, and the child be set aside for further enquiry.

In practice, it is best to combine the two methods of inspection ; for example, to see the children rapidly twice a week, and to conduct a careful examination of every eye once a month or so.

Inspections are best undertaken early in the morning, that is, before the inmates have had any opportunity of washing their faces. By adopting this simple precaution, instances of slight discharge or of trivial photophobia will be readily detected.

The methodical examination should take place in a well-lighted room, large enough to hold a considerable number of persons at one time. The surgeon stands with his back to a large window that faces north, and has an assistant seated at his side to take notes. The children, who are first drawn up in lines, are presented to him one after the other in rapid succession, and leave the room directly after examination. Such a method shortens the labour of inspection, so that by constant practice it becomes quite possible to see 150 to 200 scholars in a single hour.

The surgeon should be provided with three instruments, namely, a pair of epilation forceps, a small scalpel, and a spud for the removal of foreign bodies from the eye. Water, towels, soap, and nailbrush should be close at hand, and it is scarcely necessary to add that the fingers ought to be thoroughly cleansed after examining any suspicious case. Were that obvious precaution neglected, the surgeon might be the means of infecting healthy children, an occurrence that seems to have taken place more than once. For similar reasons, it is advisable to avoid as much as possible any direct contact between the finger and the mucous membrane of the lids.

The examination includes :—(a) external inspection of the eyes, so as to detect redness or ulceration of the lids, discharge, photophobia, congestion of the bulbar conjunctiva, or other obvious appearance ; (b) careful scrutiny of the cornea, so as to find out if foreign bodies, ulcers, or pannus be present ; (c) exposure of the conjunctival surface of both the upper and the lower lid, to ascertain the presence or absence of "granulations." The results are communicated to the assistant, who enters them at once upon a suitable form.

The medical man, when engaged in examining a large number of children, will often come across the following conditions, with the essential nature of which he should be thoroughly conversant.

Foreign bodies—as bits of grit or particles of straw—may be embedded in the corneal epithelium, or, more commonly, may lie free upon the conjunctiva of the upper lid, in its subtarsal sinus. Eyelashes, too, are often observed free about the conjunctiva, and occasionally one finds its way into the lower punctum lacrymale, in which case its protruding point may irritate the cornea considerably. As a rarity, a cilium may lodge in the upper punctum.

One not infrequently sees a bundle of 2 to 6 lashes tucked in, as it were, at the outer corner of the eye. The cilia are derived from the outer part of the upper lid, and may cause considerable irritation of the conjunctiva. As a rule, their free ends show a morsel of mucous secretion. Certain individuals have a tendency towards this

small displacement, which appears to be due to energetic friction with the towel in drying the face. The remedy, of course, is to draw the lashes into their natural position. In very obstinate cases, it may be necessary to destroy the hair follicle by electrolysis, an operation described later in this book.

Styes will be often noticed, and should be opened early. In children they sometimes give rise to a good deal of chemosis, as well as to great swelling of the lids.

The elevations known as "phlyctenulæ" will be often met with, and should be always put under treatment. To a large extent, they are constitutional, and affect given children over and over again. They occur in small epidemics, which are associated with easterly winds or with sudden alterations in weather. Their treatment consists in the administration of cod liver oil or tonics, while locally the best application is an ointment containing 2 per cent. of the ammoniated mercury or of the yellow oxide salt.

Blepharitis is sometimes associated with the last named condition, although more frequently it occurs alone. It is common as regards particular children, and appears to be definitely under the influence of weather changes. It sometimes gives rise to a secondary inflammation of the conjunctiva, that can be cured only by attending to its cause. Full details as to the treatment of blepharitis will be given in a later section of this book (*see p. 213*).

Hæmorrhage beneath the conjunctiva is common enough in any large school, and generally results from traumatism. A statement is current in the text-books that it is sometimes indicative of night-epilepsy, a claim that I have never been able to substantiate. The iris often looks greenish, a phenomenon due to diffusion of blood between the lamellæ of the cornea. It may be noted in this connection that minute hæmorrhages are often seen upon the conjunctiva of the lower lid. They have, so far as I am aware, no particular significance. Hæmorrhage into the anterior chamber of the eye is known as *Hyphaema*, and usually follows blows or other injuries. The blood, commonly derived from the iris, sinks to the lower part of the chamber, where it forms a plum-coloured layer,

the upper part of which has often a lighter hue. It may hide the pupil either wholly or in part, and subsides spontaneously.

A striking appearance is produced by localised dilatation of the lymph vessels of the bulbar conjunctiva. A group of transparent blebs, strung together like the pearls of a necklace, lies upon the "white of the eye," and is freely movable along with the membrane on which it is situated. Signs of inflammation are not observed. No treatment is needed.

Localised redness of the palpebral conjunctiva is generally due to an underlying Meibomian cyst or to a small abscess in the glandular duct, conditions both of which are common in children.

There is a curious state of the bulbar conjunctiva known as Epithelial Zerosis, with which the surgeon will do well to be familiar. It is by no means uncommon in parochial schools, although, for that matter, it may be met with occasionally in those of a higher class. For example, it was noted thirty times during the examination already mentioned as having been conducted by me a few years ago. One or both eyes may be affected, and the pathognomonic sign is that of a small, dry, lustreless spot situated upon the inner or outer side of the cornea. The patch, which looks as though it were covered with foam, has the form of a triangle, the base of which is directed towards the cornea, its apex towards the temple. Epithelial zerosis affects by preference badly nourished children, and in some, but not in all, instances is associated with night-blindness, or *hemeralopia*, as it is called. Treatment consists in attention to diet, together with the administration of liberal doses of cod-liver oil.

Lastly, one may encounter small, hard, yellowish dots or streaks lying in the ducts of the Meibomian glands. They probably result from a sort of calcareous degeneration of retained secretion, and should they give rise to irritation, may be picked out with the point of a cataract needle.

The medical man should carefully bear in mind that, among any large number of children, anomalous cases will every now and then crop up. Under such circumstances, he must be guided by what he

knows of the patient's clinical history, a knowledge that will often stand him in good stead.

Outbreaks of contagious ophthalmia have in many instances been ushered in by measles. This fact was strikingly illustrated in the parish schools at Norwood some few years ago. During 1885, the proportion of ophthalmia ranged between 1 per cent. and 8 per cent., the latter figure having been recorded after a slight outbreak of rubeola. On 20th February, 1886, the ophthalmic cases formed 2·59 per cent. of the total school population. Measles then made its appearance, and reached its highest point some five weeks later, when 21·15 per cent. of the children were affected. From that date the number of cases gradually lessened, and the ailment disappeared altogether by the 22nd of the next month. During the whole of this period—that is, from 20th February to 22nd May—the percentage of ophthalmia patients fluctuated between 2·06 and 4·81. As soon, however, as the measles came to an end, ophthalmic cases began to increase, and during the next fourteen weeks, the return showed 12·50 per cent., 11·92 per cent., 13·94 per cent., 15·06 per cent., 16·45 per cent., 18·42 per cent., 16·35 per cent., 30·50 per cent., 27·74 per cent., 25·95 per cent., 22·29 per cent., 21·69 per cent., 22·22 per cent., and 54·90 per cent. The affected children, as mentioned in an earlier part of the present paper, were then removed to the Lambeth Infirmary.

Another recent instance is afforded by the South Metropolitan District School at Sutton, where measles appeared among the infants in November, 1892. Upon the 14th of that month an entry was made of 114 cases. Upon 3rd December, 6 cases only were reported, so that the epidemic was practically at an end. During this period the boys were also attacked, and upon the 17th of December, 66 cases were observed, but the disease cleared away before the next fortnightly return was made. Throughout the whole of this time not a single case of rubeola occurred among the girls. The school was next invaded by acute ophthalmia, the stress of which fell upon the boys and infants, that is to say, upon the classes of children who had been previously affected by measles. By 16th

September, 1893—*i.e.*, about nine months after the outbreak of measles had terminated—134 boys and 99 infants were returned as suffering from ophthalmia. On the other hand, the girls—who had no measles—showed only a few cases of chronic ophthalmia, which could be readily accounted for in other ways. The association between the two maladies comes out clearly if a sketch-diagram be made. As soon as the rubeola line has fallen to zero, the ophthalmia line begins to rise, almost at once in the case of the infants, and after some slight delay as regards the boys.

There would be no difficulty in multiplying instances, but the foregoing will suffice to draw attention to the close relationship between measles and ophthalmia. From their study one learns that although ophthalmia shows an increase as soon as measles has subsided, it nevertheless takes a considerable time to reach its maximum.* The first point may be explained by the well known facts that rubeola often leaves behind a chronic inflammation of the lids, and that it has a tendency to kindle afresh any former conjunctival trouble. The second point probably means that the ophthalmia set up by measles has spread to other children, who may or may not have had the zymotic affection. There can be little doubt, moreover—explain

* During the year 1892, I had an opportunity of observing closely an epidemic of measles that attacked from start to finish 97 children, of whom 19 alone manifested no ocular complications during the eruptive stage. In the remaining 78 cases one or more of the following conditions were present:—(1) redness around the cornea, most marked at its inner or outer side; (2) rubeolous eruption upon the palpebral conjunctiva, rendering that membrane red and thick; (3) more or less muco-purulent secretion; (4) sub-conjunctival haemorrhages, few or many, large or small; (5) photophobia; (6) lacrymation. The later complications may be thus enumerated:—(1) small abscesses in the Meibomian glands, noted in 16 patients. These chiefly affected the lower lid, often some time after measles had run its course, and in particular cases recurred again and again; (2) pustules along the free edge of the lids, often accompanied or followed by blepharitis; (3) stasis of blood in one or more of the veins of the bulbar conjunctiva. The appearance was that of an enlarged vessel, the contents of which might be displaced, although they could not be altogether emptied; (4) phlyctenular inflammation of the conjunctiva (3 cases) or of cornea (1 case).

Throughout the epidemic special attention was paid to the condition of the eyes, yet it was ultimately found necessary to separate 15 children, no less than 11 of whom had suffered at some former time from “bad eyes.” In other words, while only 5 per cent. of the previously healthy children were isolated, as many as 37 per cent. of the others demanded that step. The latter were presumably the possessors of a more or less damaged conjunctiva.

it as we will—that rubeola renders individuals more liable than they would otherwise be to receive the *contagium* of the different infectious eye disorders. In short, measles is not only an exciting, but also a predisposing cause of ophthalmia. Finally, it should not be forgotten that measles is now and again followed by a form of leucorrhœa, which possibly accounts for some of the severer cases of ophthalmia.

From a practical point of view, therefore, a school doctor will act wisely in forbidding patients who have recently suffered from measles from mixing with healthy children, until the lids are free from redness or discharge. Further, inspections should be multiplied for two or three months after an epidemic of rubeola.

Although I have had numerous opportunities of observing outbreaks of hooping cough, scarlet fever, Rötheln, and influenza among children, yet I have never seen any of the ailments named give rise to ophthalmia, pure and simple.

In some schools a point has been made during epidemic periods of bathing the eyes of healthy children with a medicinal lotion—for example, boric—with the idea of preventing the development of ophthalmia. The measure is troublesome to carry out. It may, indeed, be an actual source of danger, since contagious particles may be passed from one eye to another by the fingers of a nurse, or by the indiscriminate use of pipettes, syringes, lotion, or cotton wool. The practice possesses no prophylactic virtue. It should, therefore, never be adopted.

The measures that have been described in former pages for the stamping out of epidemic ophthalmia may be thus briefly summed up:—

1. Isolation of every affected child.
2. Skilled medical treatment and nursing.
3. Systematic inspection of all eyes.
4. Examination of every candidate for admission to the school.
5. The use of the “jet system” both for washing and for bathing.
6. Separate towels, sponges, beds, linen, clothing, &c., &c.
7. Attention to the requirements of a healthy existence, viz.—
fresh air, sunlight, clean water, good food, avoidance of
overcrowding, and perfect sanitary surroundings.

A CLINICAL ENQUIRY INTO THE PREVALENCE AND SIGNIFICANCE OF THE FOLLICULAR GRANULATION OF THE CONJUNCTIVA.

UNDER the names of follicular, vesicular, or sago-grain granulations are included a series of conjunctival changes, the study of which is still involved in considerable confusion. Thus, we find no less than three widely divergent theories regarding their origin. The first is that the vesicles are outward and visible signs of the specific affection, trachoma ; a second traces the follicles to the direct influence of unhealthy surroundings ; while a third distinguishes between the true granulation of trachoma and the false granulation, which is a sign of a much less serious malady, namely, follicular conjunctivitis.

In illustration of the foregoing propositions, the views of some of the authors who have from time to time interested themselves in the subject may be briefly quoted.

The knowledge possessed by the ancients concerning granulations of the conjunctiva was, practically speaking, disregarded until the early part of the present century, when the prevalence of epidemic ophthalmia among soldiers once more directed attention to the subject. John Cunningham Saunders⁹⁹ appears to have been one of the first—in this country at least—to recognise the frequency and importance of an accompanying chronic granular condition of the eyelids. O'Halloran,¹⁰⁰ also a British surgeon, gave in 1824 a good account of the growths. “In every large body of men,” he wrote, “persons are to be found whose eyelids are overspread by villous flocculencies or fungous productions analogous to what have been

denominated granulations, notwithstanding that from youth they may have enjoyed health, or absolute immunity from the affection under notice" (*i.e.*, chronic ophthalmia).

Some years later, Löffler¹⁰⁶—the surgeon to a Prussian regiment—found that many of the soldiers, whose conjunctiva showed the vesicular granulations, became affected later on with acute ophthalmia. He consequently looked upon those growths as a predisposing cause of the acute disease.

So long ago as 1834, Canstatt¹⁰¹ published some important statements concerning palpebral granulations. He pointed out that the growths were not exclusively confined to cases of military ophthalmia, but were also observed as a sequel to other forms of conjunctivitis, provided that they had been of long duration, or had relapsed frequently. He was of opinion, moreover, that in the latter cases the granulation was secondary and accidental, whereas it formed a primary and invariable sign of military ophthalmia.

Decondé,¹⁰² writing in the year 1849, divided palpebral granulations into two forms, viz., the vesicular and the fleshy. The former (*granulations vésiculeuses*), which were found only in the retro-tarsal folds, commenced as small projecting points. When the growths had attained their full development, they were, according to this writer, semi-transparent, as large as a millet seed, and easily ruptured by slight pressure. They were disposed in one or several rows, separated from each other by furrows, in which enlarged vessels were situated. The fleshy granulations (*granulations charnues*), on the other hand, were small, and placed closely side by side on the tarsal conjunctiva of the lids, more especially of the upper one. They bled readily on the slightest touch. Decondé regarded the vesicular granulation as characteristic of military ophthalmia, but he looked upon the fleshy growth as a secondary phenomenon by no means pathognomonic of that malady.

Hairion—who wrote in 1850, and again in 1870—applied the term “granulations” to all alterations in the conjunctiva capable of giving to that membrane an uneven and rugose appearance. He regarded the first stage of trachoma as constituted by the vesicular granulation,

which he described as follows:—"The palpebral conjunctiva is smooth, white, and of a pearly aspect, as in the normal state. Arrived at their full development, the granulations are as large as a millet seed, transparent, pellucid, discrete, and disseminated over the palpebral conjunctiva in the neighbourhood of the external commissure." In the second stage of trachoma, the conjunctiva was represented as becoming red and infiltrated by inflammatory exudations, especially around the vesicles, which by that time had become gelatinous and semi-transparent. In the third stage, the gelatinous mass had undergone fatty degeneration, and become absorbed, while the inflammatory exudation had become converted into cicatricial tissue. Red and fleshy growths were not infrequently observed. According to Hairion, the various stages of trachoma outlined above were infectious as well as contagious.

Van Roosbroeck,⁵ another Belgian oculist, gave in 1853 an account of his researches upon the subject of contagious ophthalmia. He found that the first stage—that of chronic *blennorrhœa*—caused no uneasiness to the patient. The lower lid he described as veined by branching vessels, and studded with vesicles or phlyctens, the contents of which could be readily evacuated by needle puncture. Roosbroeck made the important observation that these "phlyctens" were common enough among children and also in the peasantry, and that, after remaining unchanged for an indefinite period, they might ultimately disappear, and leave no trace of their previous existence. But if individuals thus affected entered the army, he noticed that, sooner or later, the congestion of the lids increased, the surface of the tarsal conjunctiva became villous, and larger granulations made their appearance in the retro-tarsal folds. At the same time, the caruncle became swollen, inflammation spread to the sclerotic conjunctiva, and the eyes began to discharge. The symptoms of the second stage were more severe. Thus, the palpebral conjunctiva became more and more swollen; the vesicles lost their transparency, increased in size, and no longer collapsed when punctured with a sharp needle; in other words, they had become solid. Pannus was often observed, together with ulcers of the cornea. An

abundance of muco-purulent discharge escaped from the eyes, and the patient was unable to endure light.

Warlomont¹⁰³ (1856) thought that palpebral granulations constituted the chronic stage of purulent ophthalmia, and that the vesicular became transformed into the fleshy variety. In the so-called sub-acute phase a muco-purulent secretion was present ; the bulbar conjunctiva was swollen and red ; and pain and photophobia were observed. In the third stage—namely, acute purulent ophthalmia—the lids were enormously swollen and of a livid colour, while an abundance of pus escaped whenever they were separated. Warlomont laid it down that patients whose eyes manifested granulations carried about with them the germ of mischief, which might at any time develop into the condition of purulent ophthalmia.

Marston,⁶⁰ who wrote in 1862, was of opinion that vesicles constituted the initial lesion of trachoma, and that they were not only contagious, but that they also predisposed to inflammatory affections of the conjunctiva. He was responsible, moreover, for the following generalisation, which has been adopted and repeated by many modern authors. “So certain do I feel,” said Marston, “that the prevalence of vesicular disease of the lids is in direct ratio to the amount and degree of defective sanitary arrangements, that I conceive that *the palpebral conjunctiva offers a delicate test and evidence as to the hygienic conditions of a regiment.*”

Although Marston may claim the credit of having been one of the first to enunciate concisely and clearly the significance of the follicular granulation from a sanitary standpoint, yet the grounds for his inference appear to have been founded upon the earlier investigations of Stromeyer. Furthermore, two years before the appearance of Marston’s communication, much the same thing had been expressed by Philip Frank,¹⁰⁴ when he stated that “the prevalence of granular conjunctivæ in a body of men may be regarded as indicating a contaminated state of the atmosphere in which they habitually sojourn.” Frank’s general views with regard to the vesicular granulation may be gathered from the following quotation :—“Innocent as

these primary lesions may appear, they gain in importance by the predisposition they engender to inflammatory attacks, and by the contagious nature of the secretion which, under such circumstances, is furnished by the affected conjunctiva. Exposure to atmospheric vicissitudes and other sources of irritation, which in a healthy conjunctiva would lead to an attack of catarrhal inflammation or ordinary conjunctivitis, commensurate in its intensity with the nature of the exciting cause, is prone to produce most obstinate structural changes in lids affected with vesicular granulations, on account of the tendency of those bodies to assume a more advanced structural development under the influence of inflammatory irritation."

A year after the appearance of Marston's paper, Assistant-Surgeon F. H. Welch¹⁰⁵ published an elaborate paper on the so-called vesicular bodies. His conclusions were as follows:—

1st. That men may be carrying about a condition of the lids far removed from the healthy state, and yet to a casual observation not detectable.

2nd. That these "vesicles," or "sago grain bodies," whatever their nature may be, are caused by, or at least intimately dependent on, the impure state of the atmosphere in which the men live.

3rd. That the condition of the lids may be taken as a standard of the hygienic condition of the regimental quarters.

4th. That age exercises a great influence on the extent and severity of the affection.

5th. That the presence of these vesicles causes or predisposes to inflammatory attacks.

6th. That there is an intimate connection between "vesicular bodies" and "granular lids," the one being the primary stage of the other.

In 1873, we find Mr. Brudenell Carter¹⁰⁶ insisting upon the importance of the follicular granulation, and adopting the theories previously laid down by Frank, Marston, and Welch. After giving an excellent and graphic account of the naked eye and microscopic characters of the condition, he goes on to say:—"Although the

absolute exciting causes of follicular hypertrophy are unknown, and although isolated examples of it may every now and then be seen in apparently healthy persons living under favourable sanitary conditions, yet there can be no doubt of the general correctness of the view that it affords a delicate test of the sanitary state of a community. A school or regiment in which cases of follicular granulations are numerous, even though there may be an entire absence of active mischief, should be at once set down as having something radically wrong in its condition or management, and as being certain to suffer from contagious ophthalmia before long. In like manner, when contagious ophthalmia has once appeared, the children or persons who have "sago grains" still in a passive state may with tolerable certainty be pointed out as the next victims to the disease."

Mr. Carter has written elsewhere in almost identical terms concerning the significance of the follicular granulation.

If we next turn to Nettleship's "Report on Ophthalmia in the Metropolitan Pauper Schools⁵² (1874-75)," we shall find that he takes a somewhat similar view. For instance, he writes:—"The granular state of the eyelids, when only slight or moderate in degree, is not of itself a matter of much importance in most cases. It gains great consequence, however, from the fact that eyelids so affected are far more susceptible to causes of acute inflammation than healthy eyelids, that the inflammation is apt to become more severe, is much more difficult to cure, is far more likely to occur again and again, and generally leaves behind it an increase of the granular condition" (p. 57). In another place he speaks of "granular lids" as "a state which comes on in men and many lower animals under various unhealthy circumstances, and of which prolonged exposure to air made impure by organic matter and excess of moisture is probably the cause."

In a paper on "Granular Disease of the Conjunctiva and Contagious Ophthalmia"¹⁰⁷ (published about the same time as the report), Nettleship appeared to regard the vesicular granulation as forming an early stage of the specific malady, granular ophthalmia. He described the vesicles, in their further growth, as becoming larger

and more numerous, as losing their transparency, and, finally, as resembling grains of sago or tapioca. The latter might remain indolent for a considerable period of time, and then disappear, with or without scarring of the conjunctiva. On the other hand, they might, however, run into the condition familiar to everyone as trachoma, which disease followed its usual course, and ended in its usual way. Although this is the general tenour of Mr. Nettleship's paper, still he admits that "the existence of mild granular ophthalmia is a matter of very little, if any, importance" in a well managed institution. This conclusion was arrived at chiefly from the examination of 100 children at the London Orphan Asylum at Watford, where he found that 45 per cent. of the inmates presented well-marked sago grains, notwithstanding the fact that the construction, arrangement, and management of the school were all that could be desired. The additional point should be noted that the orphans in question belonged to a social class several degrees above pauper children.

In 1874, Galezowski¹⁰⁸ published his well-known paper on palpebral granulations, which he classified into false, catarrhal, and neoplastic. False granulations were grouped, according to their supposed causes, into, (a) those due to scrofula; (b) those occasioned by the instillation of atropine; and (c) those associated with affections of the tear passages. Catarrhal granulations were the result of hyperplasia of the papillæ, combined with a serous infiltration of the submucous tissues. The surface of the conjunctiva was uneven, granulous, and resembled shagreen leather, while the cul-de-sac contained villous growths, separated by fissures of greater or less depth. The neoplastic granulations constituted a leading symptom of the progressive disease, trachoma.

Sichel¹⁰⁹ published at about this time an article on conjunctival granulations, in which communication he carefully distinguished between papillary hypertrophy, on the one hand, and vesicular growths, on the other. The fact should, however, be mentioned that the papillary elevation had been recognised and accurately described by Eble in 1828. For the rest, Sichel regarded both forms as signs of trachoma.

So far, then, with the single exception of Galezowski, no writer had attempted to distinguish a true from a false vesicular granulation, although many had noticed the difference between the vesicular and the papillary overgrowth. It was left to Saemisch,¹¹⁰ in 1876, to draw a clear distinction between the two conditions. The true vesicular granulation he regarded as one of the symptoms of trachoma, while he placed the false vesicular granulation under the heading of follicular conjunctivitis. True granulations were rounded, nearly a millimetre in diameter, and were most frequently observed in the culs-de-sac, especially in that of the upper lid. False granulations, on the contrary, were oval, arranged in rows, and were found, as a general rule, on the lower lids. Another point of distinction lay in the termination of the growths; for whereas the true granulation always left scars behind it, the false disappeared without leaving a trace to mark its former existence. Saemisch repeated his views concerning the difference between the true and the false granulation at the International Congress of Medical Science at Amsterdam in 1879.

Many authors have adopted the views laid down by Saemisch in his noteworthy contribution to the subject.

De Wecker,¹¹¹ for instance, carefully distinguishes between follicular conjunctivitis and trachoma. According to his idea, the former ailment is the result of a prolonged irritation, which causes the physiological elements of the mucous membrane to undergo an unusual development, while in trachoma the conjunctiva is the seat of a neoplastic growth.

Adamiuk*¹¹² (of Kasan), in his numerous communications on the subject, has consistently maintained that there is no resemblance between the two conditions. In his opinion, the follicles normally present in the conjunctiva may become enlarged in consequence of irritation, such as that resulting from dust, smoke, or accommodative strain. He terms this state of things "folli-

* Professor Adamiuk has been good enough to confirm the foregoing views in a private communication to me.

culosis," and does not regard it as at all dangerous, as subsiding, indeed, as soon as the irritation is done away with. Trachoma, on the other hand, according to this observer, never arises as the result of imperfect sanitary surroundings, but from specific infection exclusively. At the same time, it is important to note that Adamiuk believes that folliculosis may prepare the soil, so to speak, for the contagious seed of trachoma.

Edwin van Millingen³⁹ (of Constantinople), who enjoys exceptional opportunities for studying the various forms of ophthalmia, maintains that the granulations of follicular catarrh are essentially different from those of trachoma, and that the one does not in any way predispose to the other. His conclusions are based partly on clinical experience, and partly on actual experiment. Clinically, he found that while follicular conjunctivitis was very scarce in Constantinople, trachoma was exceedingly common. Thus, the former affection was met with in 0·2 per cent. of all ophthalmic patients, while the latter reached as high a percentage as 17. Millingen's first experiments were made upon rabbits, which animals, however, were soon found to be immune from contagion. Observations were extended, therefore, to the healthy conjunctiva of human eyes that were incurably blind. In order to ascertain whether tissue from a trachomatous eye was capable of infecting a sound organ, he excised small portions of diseased conjunctiva and transplanted them into healthy membrane. But all attempts at inoculation failed signally. Further experiments convinced him, however, that discharge taken from acute or chronic trachoma, when introduced into the healthy conjunctival sac, rarely failed to set up an identical malady. Hence, according to these experiments, trachoma is communicable by transfer of its secretion, but not by inoculation. With regard to follicular conjunctivitis, the case is wholly different ; neither the contact of its discharge nor the transplantation of the vesicular granulation is able to reproduce the disorder. If we accept van Millingen's conclusions, then, the malady is neither inoculable nor contagious, thus differing markedly from trachoma.

One may perhaps mention that van Millingen's results are

diametrically opposed to those obtained by Sattler, who succeeded in reproducing trachoma by inoculating one of the characteristic granules (*Bericht der Ophth. Gesellschaft*, 1881, p. 23).

Fuchs¹⁰ concludes an exceedingly practical account of follicular conjunctivitis with these words:—"The most important difference between the two affections lies in their progress. Follicular catarrh is not accompanied by papillary hypertrophy of the conjunctiva, or at least if that condition be present, it is of slight degree; it never produces shrinking of the conjunctiva, pannus, or any of the other consequences of trachoma; it is an affection absolutely devoid of danger. Moreover, it subsides without leaving traces, so that on that score alone a distinction between the two maladies is of great importance, not merely theoretically, but also practically."

Würdeman¹¹³ published, in 1890, an excellent paper on the diagnosis between trachoma and follicular conjunctivitis, which contained the following significant passage:—"In the examination of our Milwaukee schools, in which are a great number of children of foreign parentage, I found but few cases of trachoma, while the follicular disease was relatively common."

Schmidt-Rimpler,¹¹⁴ during the course of a discussion at the International Medical Congress at Berlin in the same year, expressed his belief that the two affections were of a different nature. According to his investigations, the follicular condition could be demonstrated in 27 per cent. of the students whom he had examined, whereas trachoma was found in 1 per cent. only. In his opinion, the latter malady forms a well-defined and characteristic morbid entity, and should on that account be separated from follicular conjunctivitis.

Panas,²³⁹ in his recently published work, repudiates the theory that the vesicular granulation constitutes the first stage of trachoma. "The proof to the contrary," to quote his words, "is furnished by the appearance of identical vesicles on the almost healthy conjunctiva of man and of animals" (p. 224).

These conclusions, however, have been by no means universally accepted. Certain observers—more especially those who have taken

up the pathological side of the question—assert that the two conditions are identical. The most prominent advocates of this view are, perhaps, Raehlmann and Mandelstamm. Relying upon an assumption that the histological changes are identical in the two maladies, Raehlmann¹¹⁵ goes so far as to assert that there is absolutely no quantitative or qualitative distinction between them, and classes as trachoma all follicular affections of the conjunctiva. Mandelstamm,¹¹⁶ as the result of his pathological investigations, makes an almost identical statement. He claims to have demonstrated the same pathological changes in all forms of “granular lids,” and he believes that trachoma is in no sense a specific disease. His reasons for the latter statement may be thus summarised:—First, that there are no histological changes in trachoma which are absent from follicular catarrh, or, for that matter, from most other forms of conjunctival inflammation. Secondly, that acute follicular catarrh cannot be distinguished, either clinically or anatomically, from trachoma. Thirdly, that the presence of micrococci rather militates than otherwise against the specific nature of trachoma, inasmuch as a similar organism has been also found in blennorrhœa. Lastly, that it is impossible to decide in what direction the morbid process will develop when dealing with an inflamed mucous membrane, the follicles of which are enlarged. In short, Mandelstamm thinks that there are two principal forms of trachoma, viz.:—a follicular or granular, and a papillary or epithelial; he admits, however, that intermediate varieties may often be met with.

Any account of the literature of trachoma would be incomplete if it failed to include the ingenious theory propounded by Mutermilch¹¹⁷ in 1893. To put the matter briefly, he claims that the same anatomical changes may be demonstrated in all inflammations—simple or otherwise—of the conjunctiva. According to his views, the follicle results from a lymphoid infiltration of the sub-epithelial adenoid tissue, and may accompany any kind of conjunctivitis, whatever its origin and intensity. He points out that a constant relation exists between the epithelial and the sub-epithelial tissues all over the body. Adenoid tissue, for example, is never found along

with epidermoid epithelium, nor is a substratum of connective tissue associated with mucous or cylindrical epithelium. From a physiological standpoint this arrangement, he says, may be readily accounted for. Mucous epithelium constitutes, as it were, an independent secretory organ, requiring abundant nutriment, which it imbibes from the loose and vascular sub-epithelial tissues. The regeneration of the epithelioid elements capping adenoid tissue accordingly takes place with great rapidity, and to this latter fact the power of resistance possessed by the healthy conjunctiva is due. Under the influence of strong irritation, however, activity of the mucous elements becomes exaggerated, and they break up rapidly, while new elements are just as quickly formed. This process is seen in the mild conjunctivitis that follows irritation by smoke, dust, or chemical fumes, where the young epithelial cells lying directly over the adenoid tissue not only repair breaches in the superficial rows, but reproduce their kind so abundantly that the epithelial layer becomes notably thickened. In old standing cases of trachoma, it is found that the epithelium has changed its type; that it has assumed epidermoid characters; and that it now overlies compact connective instead of adenoid tissue, as in the normal condition. In other words, an anatomical balance has been struck between the epithelium and its basis: the conjunctiva has become as resistant as it was before the trachoma, and, indeed, has approached the structure of epidermis. Under these circumstances, the inflammatory processes may be said to have died a natural death.

The transformation of columnar into squamous epithelium results from successive inflammatory attacks. If the inflammatory process has been slight and of short duration, the cellular infiltration is partly absorbed and partly thrown off into the conjunctival sac, and the *status quo* is maintained. On the other hand, if it be often repeated or chronic, the follicles are replaced by connective tissue of new formation, a modification that must materially influence both the nutrition and form of the epithelium. And, in point of fact, the epithelium tends to assume epithelial characters. Put in another light, the eye has now become trachomatous, its powers of resistance

are weakened, and it is attacked by recurrent inflammations and pannus. With each access of inflammation the adenoid becomes richer in connective tissue, the epithelium assumes epidermoid characters, its superficial cells receive less nourishment and accordingly become dry, until, finally, the surface of the conjunctiva is covered with a structure that possesses the characters and properties of epidermis. The trachoma thus terminates, and the powers of resistance of the conjunctiva are restored.

From the foregoing it will be gathered that, in Mutermilch's opinion, all inflammations of the conjunctiva, irrespective of their origin, may pass into typical trachoma; and that trachoma, although it may result from various infective inflammations, is not itself contagious.

Apropos of the recent discussion at the Ophthalmological Society on School Ophthalmia (March 1894), one finds the following advice given in a leading article in one of the chief medical journals²⁴⁰ :—“There is some difference of opinion as to whether contagious ophthalmia invariably commences and has its *rôle* in certain follicular structures of the conjunctiva, giving rise to what are known as ‘sago grain’ granulations. It is sometimes difficult to say, in slight cases, whether enlarged follicles are the objective mark of the initial stage of the disease, or are only a personal peculiarity; and it is certain that, in the later pathological stages of the affection, other and surrounding structures are involved. The condition of the palpebral conjunctiva, as regards the appearance of these enlarged follicular structures or ‘sago grain’ condition, may even afford a delicate test of the hygienic state of a regiment, school, or other community. Their presence is not attended by any subjective phenomena. If they become a trifle vascular, they may give rise, perhaps, to a little blinking in the sun or some lacrymation. They must be carefully sought for to be discovered. The subjects of them are, however, very prone to ophthalmia on exposure to any exciting causes, and the disease sometimes assumes an acute purulent form, or, more frequently, becomes chronic, leading to trachoma and grave impairment of vision.”

Here we are confronted with absolute statements concerning the importance of the palpebral granulation, which is regarded much as it was before the appearance of Saemisch's paper, and no mention is made of the clinical distinction between the various kinds of granulations. Furthermore, it is assumed that the follicular granulation (1) is produced by unhealthy surroundings ; (2) may be the cause of purulent ophthalmia ; and (3) is the forerunner of trachoma. So long as such views find currency in medical journals, the practitioner can scarcely be blamed for looking upon all kinds of conjunctival overgrowths as matters of grave moment and importance, more especially from the preventive standpoint.

The authors of the various modern text-books, also, take up strangely dissimilar views. Of course, all writers recognise a distinction between papillary granulations, on the one hand, and "sago grains" on the other, and regard both conditions as symptomatic of trachoma, but with respect to the vesicular granulation, there is no such unanimity of opinion. For example, one group draws no distinction between follicular granulations and the granulations characteristic of trachoma. If described at all, the former are looked upon as an early stage of the latter (Higgens). A second group, while pointing out that such a distinction has been made, either questions its foundation in fact, or refuses on practical grounds to accept the division (Nettleship). A third group differentiates the true from the false granulation — that is, trachoma from follicular conjunctivitis (Lawson, Meyer, De Schweinitz, Fuchs, Swanzy and Werner, Panas).

This curious divergence of opinion is fraught with the possibility of evil consequences. Medical men in charge of schools, parochial or otherwise, turn to the text-book that they may chance to possess, and are to a large extent guided by the directions they find therein. It is quite likely that they may thus be induced to treat actively all sorts, kinds, and descriptions of granulations, a mistake in judgment that need be mentioned only to be condemned.

To take another instance, the following statement appears in a series of rules²⁴¹ for the prevention of disease, published under the auspices of the *Medical Officers of Schools Association* :—

“When purulent ophthalmia appears in a school, the under surface of the upper eyelids of every pupil should be turned up and examined, and all those that have any granulations visible should at once be properly isolated.” As readers will perceive later on, the position of a medical man who endeavoured to carry out this advice can be better imagined than described, more particularly if to isolation were added any kind of active treatment.

What has been my own experience with regard to this question may be now briefly described.

Imbued with the theory that the follicular granulation was an early stage of trachoma, I assumed in the latter part of 1886, the management of an epidemic of ophthalmia in the Lambeth Schools, at Norwood. In addition to treating all acute forms of disease, I isolated and treated a considerable number of children in whom the follicles were large or numerous, whether other symptoms of disease were or were not present. The underlying idea was that the malady would become progressively worse in the absence of suitable medication.

Now, one portion of my duties lay in examining all newcomers to the institution, and in recording the condition of their eyes. In process of time I found that a more or less advanced follicular condition existed in a large percentage of these children, the majority of whom, it must be remembered, had not previously been inmates of a parochial school. Indeed, it soon became obvious that if children were to be rejected on the score of existing granulations, it would be necessary to return to the Union some 75 per cent. of the total number presented for admission. It was this observation that first led me to doubt the accuracy of the theory that follicles formed the early stage of trachoma.

I next kept under careful observation certain children known to possess well marked follicular granulations, in order to ascertain whether they developed acute ophthalmia in greater proportion than those whose conjunctiva was relatively healthy. Notwithstanding an experience of nearly two years, I was never able to convince myself that such was really the case. One point alone was perfectly clear,

viz., that, broadly speaking, the granulations remained stationary, becoming neither smaller nor larger.

My next connection with ophthalmia was in 1889, at the Central London District School, at Hanwell. My former belief—that the follicular granulation formed an early sign of trachoma—I had by that time almost wholly abandoned, although I was still inclined to the view that lids containing those growths were, *ipso facto*, predisposed to acute ophthalmia. Accordingly, I refrained from interfering too actively with cases where a slight or moderate amount of follicular enlargement constituted the only visible change. On the other hand, all instances of trachoma and of acute disease were, of course, rigidly isolated and placed under systematic treatment.

The Norwood experience was repeated, but this time upon a larger scale. For example, during 1889-90, admissions to the school numbered 211, and out of that number 24.17 per cent. had conjunctivæ free or almost free from vesicular granulations. During 1890-91 again, among 209 newcomers, 29.67 per cent. were noted as free from change. To be brief, between September 19, 1889, and May 24, 1894, out of a total of 1,563 admissions, 217, or 13 per cent., only possessed lids free (or nearly free) from vesicular change. It will thus be seen that the Norwood and the Hanwell experiences tallied closely on these points, and it is not surprising that under the circumstances my faith in the potential evil assigned to the follicular granulation was considerably weakened.*

Before coming under the care of the Poor Law, a great majority of the fresh admissions had attended various London Board Schools, and I surmised that the follicular granulation must be present in a large percentage of the poorer children of the metropolis.

The facts at disposal, however, did not warrant any definite conclusion with regard to the significance of the growth. On logical

* The discrepancy that will be noted between the percentage of "normal" lids during 1889-91, and that for the years 1889-94, is due to the fact that a somewhat lower standard was at first adopted.

grounds it became necessary as a first step towards solving the problem to ascertain the condition of the lids in a large number of children.

The fallacies surrounding such an inquiry were of two kinds—general and special.

The first general fallacy concerned the number of observations. It was clear that at least some thousands of children would have to be examined; for any generalisation founded on small numbers would be untrustworthy. Secondly, in order to ascertain the exact distribution of the condition, those examined must belong to various social grades, and not be drawn from any single class, such as the parochial. Thirdly, to exclude the possible fallacy that the follicular granulation might be confined to the inmates of boarding schools, it became necessary to include day schools in the investigation. Fourthly, an obvious fallacy would be avoided by extending the inspections over a comparatively wide geographical area. Lastly, other sources of error would be excluded by including children of all ages, boys as well as girls, in one systematic examination.

The general fallacies of such an investigation might be avoided, then, by the exercise of due care. Unfortunately, the same cannot be said with regard to the special sources of error, which were mainly concerned with the fixing and maintenance of an equable standard of comparison between the different schools. By conducting the enquiry within a comparatively limited period of time, it was hoped to minimise, to some extent at least, the especial fallacy of what may be termed a shifting standard. Accordingly, the work was carried out between August 20, 1891, and March 3, 1892, a precaution that was certainly of service.

Another special fallacy lay in the difficulty—or, even, in some instances, the impossibility—of determining whether slight follicular granulations were or were not present. Frank, who fully recognised this diagnostic stumbling-block, wrote, “The influence of a hyperæmic condition in masking vesicular grains can be readily appreciated by their disappearing, as it were, before the very eyes of the observer, when a lid has been kept everted for a short time, and reappearing

again when the congestion has been allowed to subside." This fallacy has been recognised by all observers, and, in point of fact, a few minute vesicles may easily escape detection, especially when from any cause the palpebral conjunctiva is unduly red. With regard to the presence of marked follicles, there can be no difference of opinion, at least between competent observers ; a difficulty can arise only when the growths are small and the membrane congested, either locally or generally. Still, this special fallacy is perhaps the most important of the series, and due weight must be attached to it in estimating the significance of the figures that follow.

A special fallacy—the converse, in some respects, of the last named—lay in the possibility of mistaking for enlarged follicles those peculiar tortuosities of the conjunctival vessels, not infrequently met with in the lower lids. It is most difficult, when confronted by this curious anatomical condition, to decide whether small vesicles are or are not present.

The difficulty of distinguishing between an advanced condition of follicular enlargement and the early stage of trachoma has been dwelt upon by more than one author, and might, perhaps, be regarded as constituting another special fallacy. Among the total number of children examined, however, this difficulty seldom presented itself. Now and then, when inspecting an eye which had been recently affected with one or other form of acute ophthalmia, and in which the conjunctiva was still red and thick, considerable doubt existed in my mind as to the proper classification of the case. Under such circumstances, I was guided by the presence or absence of the signs to be described immediately as characteristic of trachoma.

At the outset of the enquiry it became evident that precise terms must be used to denote particular conditions of the conjunctiva. Much of the confusion heretofore surrounding the subject has been caused, no doubt, by looseness of expression, and by different authors assigning to the same term diverse meanings. For instance, by some the words "follicular," "vesicular," and "'sago-grain' granulation," have been regarded as synonymous and interchangeable, while they have been employed by others to indicate

separate conditions. The expression "granular lids," also, has been used in various senses. Thus, one set of writers include under that common denomination all growths or granulations of the conjunctiva; whereas a second use "granular lids" as the precise equivalent of the specific malady, trachoma, and apply it to no other condition. In short, there is little doubt that a diffuse, elastic, and unfortunate terminology has been the starting point of almost hopeless confusion, contradiction, and obscurity.

It was the knowledge of this fact that led me to draw up a definite classification, in which a knowable meaning was attached to every general term. The difficulties were considerable, although it must be confessed that they had to do, not so much with selecting precise expressions, as with holding rigidly to one standard during the examination of the various schools,—a pitfall that could not, in the very nature of things, be wholly avoided.

The expressions, "vesicle," "follicle," "vesicular granulation," and "follicular granulation," were regarded as meaning one and the same thing, *viz.*—oval, transparent bodies, the size of which seldom exceeded that of a rape seed, and was often as small as that of the point of a pin. They were usually arranged in rows running parallel with the contour of the lid, and were always larger and better marked in the inferior retrotarsal fold than elsewhere. They seldom protruded much from the plane of the conjunctiva. A single word, such as "vesiculo-grain," might advantageously replace the foregoing terms.

By "sago-grain," or "trachoma-body," was meant an opaque, rounded, and greyish-white growth, often as large as a millet seed, firmly and deeply embedded in the conjunctiva, and occurring singly or in groups. The "sago-grain," as thus defined, is always a sign of trachoma.

The expression "granular lids" was used as synonymous with trachoma, and was never applied to any case that merely manifested the presence of the vesiculo-grain.

The terms "papillary granulation," "papillary hypertrophy," "papillary proliferation," or "papillary overgrowth," indicated that the papillæ of the upper—or, more rarely, of the lower—lid were

enlarged, and capable of being recognised by the naked eye. In slight cases, the surface of the conjunctiva resembled that of fine sand-paper, while in marked cases, it was more like the pile of velvet.

The ground having been so far cleared, the following classification was framed to include every conjunctiva under one of three heads, namely,—(I.) eyelids in which no growths were observed; (II.) eyelids that manifested the presence of vesiculo-grains, or of slight papillary proliferations; and (III.) eyelids that showed incontestable evidences of the present or past existence of trachoma. A further point must be mentioned: now and then the eyes of a particular individual were found to be differently affected. For instance, the right eye might be trachomatous and the left follicular. Under such circumstances, the condition would be invariably classed as trachoma.

We may now proceed to a detailed account of the varieties included under the foregoing classification.

Group I. No vesicles, follicles, or sago-grains to be seen in the conjunctiva.

Group II. Under the generic title "follicular granulations," the following conditions were included:—(a) Discrete, transparent growths, often of a yellowish hue, and disposed in one or more rows in the central zone of each lower lid. They ranged in diameter from 0·25 mm. to 2 mm., and were usually few in number. (b) A single row of minute, semi-transparent bodies, running in a line with the outer third of the lower lid, at about 3 mm. from its edge. As a general rule, the size of these vesiculo-grains becomes smaller the farther they reach towards the inner canthus of the eye. (c) Small vesicles lying at the inner and outer corner of each upper lid, their site being usually marked by local redness. In a more pronounced form, they fringe the membrane that lies between those two points, in which case their existence may be always demonstrated in the superior cul-de-sac. (d) The conjunctiva overlying the tarsus of the upper lid is sprinkled, as it were, with few or many whitish, semi-spherical growths of minute dimensions. They are not transparent, and appear to be firmly attached to the substance of the membrane. (e) In the last class, vesicles are absent or inconspicuous. The

changes here take the form of minute papillary overgrowths from the superior tarsal conjunctiva, which thus loses its polish. Occasionally, however, the membrane is studded by more definite growths, but they are always of small size, and merely render the surface of the lid somewhat uneven, so that it reflects light irregularly. The sand-paper simile, used before, gives a good idea of the appearance.

The conditions described above were frequently found to exist side by side in a given case. Thus, the commonest clinical picture was made up of the changes lettered *a*, *b*, and *c*. On the other hand, *d* was distinctly uncommon, a remark that applies equally to *e*.

It is important to note that in all the foregoing types of change the conjunctiva was not deeply involved; but for the presence of the follicles it generally seemed, indeed, to be fairly normal. The fact should be added that the condition of the conjunctiva with regard to its vascularity differed according to the case. Sometimes pale, it was equally often reddened, and the congestion might be strictly local or possess a more general distribution. A system of vessels, ramifying like the branches of a tree, was often visible in the lower lid, while the superior cul-de-sac was generally traversed by fine parallel vascular twigs.

Group III. No case was classed as trachoma unless signs of the present or past existence of the malady could be demonstrated. Much care and no little experience are needed to distinguish between an advanced condition of follicular granulation, on the one hand, and an early stage of trachoma, on the other, but a mistake in diagnosis can hardly occur except under those circumstances. The following appearances, either singly or in combination, were present in every case recorded as trachoma. (*a*) "Sago-grains,"—which are pathognomonic of trachoma—that is, greyish, opaque masses, seldom much raised above the level of the surrounding tissues. They are so friable as to bleed on slight handling, and close examination will often show that a minute haemorrhage lies at the centre of each. Their contour is, roughly, circular, and they are surrounded, as a rule, by a delicate network of fine vessels. They vary in number, their favourite sites being the tarsal conjunctiva and the upper fornix.

It is important to bear in mind, however, that a good light and a magnifying glass may be needed to detect them in slightly marked cases; under such circumstances, the test position is the tarsal edge of the upper lid, *i.e.*, the anterior edge of the superior cul-de-sac. It has been claimed by more than one observer that the mere existence of growths upon the ocular conjunctiva constitutes proof of trachoma. In point of fact, however, vesiculo-grains may be now and then found on that membrane; so that the question of diagnosis turns in reality upon the naked-eye characters possessed by the growth—*i.e.*, whether it is a vesiculo-grain or a true sago-grain. Position, then, does not, in my opinion, afford sufficient ground for any conclusion as to the nature of the diseased process. (*b*) A diffuse infiltration of the conjunctiva and sub-conjunctival tissues with what, for want of a better name, may be called trachomatous material. The effect of this pathological change is to make the membrane look as if it were stuffed with red jelly, an appearance often strikingly obvious in the neighbourhood of the caruncle and superior retro-tarsal fold. (*c*) Gross papillary hypertrophy of a severity and description never associated, in my experience, with the follicular granulation, pure and simple. The changes (practically confined to the upper lid) often remind one of the roughened surface of a nut-meg grater, or, in still coarser type, of shagreen or velvet pile. The “villous” or “shaggy” eyelid is an expression that often occurs in the older authors to indicate this latter condition. The proliferations, which readily bleed, are of a livid red hue, while they are frequently intersected by furrows containing muco-purulent secretion. A very similar appearance is met with during the recession of purulent ophthalmia, but the distinction between the last named condition and trachoma can be usually established by the history of the case. (*d*) Scars of the palpebral conjunctiva, not due to ophthalmia neonatorum, to diphtheritic inflammation, or to traumatism. Commencing as small grey points, they increase both in size and number, and, finally, sometimes form a more or less continuous sheet of cicatricial tissue, interrupted by islands, as it were, of hypertrophied papillæ. The scars of trachoma

commonly make their first appearance in the superior cul-de-sac, from whence they extend on to the body of the upper lid; a characteristic position—as long ago pointed out by Mr. Nettleship—is the subtarsal sinus of the latter structure. (e) Thickening and deformity of the tarsus of the upper lid. (f) Drooping of the upper lid, although not absolutely characteristic, is exceedingly suggestive of trachoma, more especially when associated with long standing or relapsing inflammation of the eye. (g) Obliteration, partial or complete, of the conjunctival culls-de-sac. A similar condition, associated with pemphigus, was encountered once during the course of the enquiry, but it was not, of course, included among the cases of trachoma. (h) Trichiasis resulting either from the traction of conjunctival cicatrices or from malposition of the tarsus. (i) Pannus or indolent ulcerations of the cornea accompanied by a thickened, bossy, and granular condition of the upper lid and superior fornix.

Of these changes, those indicated by the letters *a*, *b*, *c*, and *i* obviously indicate trachoma in an active state, whereas those lettered *d*, *e*, *f*, *g*, and *h* are more in the nature of sequelæ. At the same time, it is not rare to find some of the latter, notably scarring (*d*), in active cases.

The following uniform method of examination was adopted throughout the investigation. In the first place, the presence or absence of discharge from the eye and the condition of the cornea were recorded. The upper and the under eyelids were then everted, so as to expose their conjunctival surfaces freely. The superior cul-de-sac was brought into view in certain instances only, as for example, where any doubt existed about the precise nature of the changes present. All details were at once entered on a printed form, together with the name and age of the child.

The inquiry, as stated before, was carried out between August 20, 1891, and March 3, 1892, and the total number of those examined amounted to 14,797. It included male and female children, whose ages ranged from 2 to 19 years. It embraced schools in the counties of Middlesex, Surrey, Nottingham, Leicester, Lancashire, Yorkshire, Oxford, and Kent. The investigation, it should be noted, did not

comprise the inmate of a single pauper school. It was confined, on the contrary, to public or semi-public schools, to Board and to Church schools, to higher-grade schools, and to a couple of orphanages.

Before proceeding to analyse our figures, it may be well to state that they lay no claim to infallibility. The inquiry was beset with many pitfalls, of which some have been already pointed out, while it is more than likely that others have escaped notice. The results, therefore, should be regarded as approximate rather than absolute, and undue stress ought not to be placed upon any individual set of figures.

Table No. I. gives the name of each school, together with the number of scholars examined. The children, it will be noticed, are divided into three classes, viz.—boys, girls, and infants, the last named being those under 7 years of age. In certain institutions (distinguished by an asterisk) a so-called “Junior,” or “Junior Mixed,” department existed, containing male and female children whose ages ranged between 6 and 11 years. For statistical purposes, however, these have been included among the infants. The table also shows the numbers and percentages of those, (a) with conjunctiva free from visible change; (b) with follicular granulations; and (c) of those with trachoma. Each of these three groups contains one or more of the classes defined and described in another part of this paper (pages 100-103).

TABLE No. I.

NAME OF SCHOOL.	No.	CLASS.	STATE OF EYELIDS.					
			Numbers.			Percentages.		
			N.	F.G.	TR.	N.	F.G.	TR.
Epsom College, Surrey,	224	Boys,	224			8.04	91.96	
Dragon School, Oxford,	59	Boys,	59	3	56	5.08	94.92	
St. Edward's School, Oxford,	92	Boys,	92	2	90	2.17	97.83	
St. John's, Leatherhead,	209	Boys,	209	12	197	5.74	94.26	
Crossley Orphanage, Halifax,	256	{ Boys,	158	10	148	6.33	93.67	
Central Foundation School of		{ Girls,	98	3	95	3.06	96.94	
London (Girls),	231	Girls,	231	9	222	3.90	96.10	
Central Foundation School of								
London (Boys),	918	{ Boys,	918	38	879	1	4.14	95.75
Seamen's Orphanage, Liverpool,	297	{ Boys,	193	14	177	2	7.25	91.71
		{ Girls,	104	6	98		5.77	94.23
		{ Boys,	164	9	155		5.49	94.51
		{ Girls,	100	4	96		4.00	96.00
		Infants,		124	6	118		4.84
				29	240		10.78	89.22
Higher Grade and Commercial	269	Boys,	269					
School, Nottingham,		Boys,	100	7	92	1	7.00	92.00
Silverwell School, Wigan,	100	{ Boys,	115	9	106		7.83	92.17
		{ Girls,	84	6	78		7.14	92.86
		Infants,		78	8		10.26	89.74
		Boys,	168	10	158		5.95	94.05
		Girls,	114	7	106	1	6.14	92.88
Old Radford Church School,	277	{ Infants,	218	14	204		6.42	93.58
		{ Girls,	141	15	126		10.64	89.36
		Infants,		263	29		11.93	88.97
*New Radford Church School,	500							
*All Saint's Schools, Nottingham,	404							

* Indicates that a so-called "Junior" or "Junior Mixed" department is in existence, which contains male and female children, whose ages range between 6 and 11 years; these children are, for statistical purposes, included among the infants.

TABLE No. I.—*continued.*

NAME OF SCHOOL.	No.	CLASS.	STATE OF EYELIDS.					
			Numbers,			Percentages.		
			N.	F.G.	TR.	N.	F.G.	TR.
Wesleyan School, Nottingham, .	514	Boys, 177 Girls, 127	210	10	167	565	94.35	
Infants, .				4	123	315	96.85	
St. Mary's (R.C.) School, Wigan, .	150	Boys, 50 Girls, 50	50	7	41	476	94.76	0.48
Infants, .				5	43	1400	82.00	4.00
Walton - on - the - Hill National School, .	300	Boys, 150 Girls, 150	150	11	139	1000	86.00	4.00
Boys, 291 Girls, 220				4	45	800	90.00	2.00
Infants, .				4	1	733	92.67	
St. Saviour's National School, Liverpool, .	595	Boys, 84 Girls, 240	84	20	215	756	95.33	
Boys, 223 Girls, 186				5	5	756	91.06	1.38
Infants, .				13	205	4	5.91	.91
Boys, 175 Girls, 177				13	173	2	5.83	.93
Boys, 202 Girls, 186				13	186	1	6.45	.54
Boys, 175 Infants, 177				17	156	3	6.44	.92
Boys, 316 Girls, 282				14	158	5	9.72	1.48
Boys, 284 Girls, 226				17	156	2	7.91	1.14
Boys, 14 Girls, 29				17	296	3	5.38	.93
Infants, .				21	258	3	7.45	.91
Boys, 76 Girls, 77				15	269	4	5.28	.94
Infants, .				12	210	4	5.31	.92
Boys, 14 Girls, 14				1	13	4	7.14	2.82
Infants, .				1	27	1	3.45	.93
Boys, 76 Girls, 77				18	57	2	100.00	3.45
Infants, .				55	4	72	5.51	96.49
Boys, 76 Girls, 77				7	70	7	5.26	94.74
Infants, .				73	73	7	9.09	90.91
							875	91.25

St. Andrew's Church School, Wigan,	286	Boys, Girls, Infants,	99	120	67	5	93	1	5.05	93.94	1.01
Thurmaston National School, Leicestershire,	259	Boys, Girls, Infants,	78	65	116	4	74	4	7.5	91.67	.83
Willesborough Board School, Kent,	314	Boys, Girls, Infants,	107	93	114	4	59	2	6.0	89.55	1.49
Norwood (Middlesex) Schools,	1008	Boys, Girls, Infants,	333	283	392	17	314	2	6.15	94.87	3.08
<i>Walton-on-the-Hill Board Schools:—</i>						12	188	6	6.90	90.77	.86
* Arnott Street School,	800	Boys, Girls, Infants,	200	200	400	6	194	6	107	92.24	.93
* Northcote Road School,	812	Boys, Girls, Infants,	200	200	412	12	188	4	100	93.46	.93
<i>Edmonton Board Schools:—</i>						20	496	1	4.30	95.70	.93
Brettenham Road School,,	1420	Boys, Girls, Infants,	517	413	490	8	405	17	473	98.25	1.45
Croyland Road School,	1080	Boys, Girls, Infants,	501	295	284	21	480	8	286	97.5	.51
New Southgate School,	373	Boys, Girls, Infants,	196	177	177	12	272	9	186	94.9	.25
GRAND TOTALS,	14,797		6700	4277	3820	821	13,908	68	5.55 %	93.99 %	.46%

* Indicates that a so-called "Junior" or "Junior Mixed" department is in existence, which contains male and female children, whose ages range between 6 and 11 years; these children are, for statistical purposes, included among the infants.

The number of children examined, then, was 14,797, of whom 6700 were boys, 4277 girls, and 3820 infants. In other words, out of every 98 inspected, 45 were boys, 28 were girls, and 25 were infants.

Of the grand total, the table shows that 821 possessed eyelids free from obvious change, while 13,908 had follicular granulations, and 68 trachoma. To vary the statement, only 5.55 per cent. presented a conjunctiva free from change of some sort, while 93.99 per cent. had follicular granulations, and the remainder, 0.46 per cent., were affected with trachoma.

The following table (No. 2) gives similar particulars about boys, girls, and infants respectively.

TABLE NO. 2.

	Numbers.			Percentages.		
	No Changes.	Follicular Granulations.	Trachoma.	No Changes.	Follicular Granulations	Trachoma.
Boys (6700), .	387	6,286	27	5.78	93.82	0.4
Girls (4277), .	210	4,043	24	4.91	94.53	0.56
Infants (3820), .	224	3,579	17	5.86	93.69	0.45
14,797	821	13,908	68	5.55	93.99	0.46

This table shows that making allowance for possible errors of observation, no practical difference exists with regard to the condition of the palpebral conjunctiva.

In table No. 3 a comparison is instituted between boarding schools, on the one hand, and day schools on the other. The boarding schools include Epsom College, the Dragon School, St. Edward's School, St. John's College, the Crossley Orphanage, and the Seamen's Orphanage, while the rest are day schools.

TABLE No. 3.

	Numbers.			Percentages.		
	No Changes.	Follicular Granulations.	Trachoma.	No Changes.	Follicular Granulations.	Trachoma.
Boarding Schools (1137), . . .	68	1,067	2	5.98	93.84	0.18
Day Schools (13,660), . . .	753	12,841	66	5.51	94.01	0.48

A glance will show that the results obtained from these two sources tallied closely. Thus, as regards lids free from change, the boarding schools show 5.89 per cent. as compared with 5.51 per cent. in the day schools; as regards follicular granulations, the former class has 93.84 per cent., the latter 94.01 per cent.; while as regards trachoma, the first manifests 0.18 per cent., the second 0.48 per cent.

The last table (No. 4) compares the whole of the schools according to the counties in which they lie.

TABLE No. 4.

COUNTY.	Number.	No Changes.	Follicular Granulations.	Trachoma.
Lancashire,	5708	6.67	92.29	1.04
Nottinghamshire, . . .	2197	7.52	92.39	0.09
Middlesex,	5091	3.69	95.93	0.38
Kent,	702	4.33	95.51	0.16
Surrey,	433	6.89	93.11	
Leicestershire, . . .	259	6.06	92.63	1.31
Yorkshire,	256	4.69	95.31	
Oxfordshire,	151	3.62	96.38	

The deductions from the above table are so obvious that they need not be dwelt upon in detail. Suffice it to say that mere geographical distribution appears to have no causative relation to folliculosis.

The foregoing, then, are the chief facts disclosed by this somewhat extensive investigation, which was confined, it must be remembered, to presumably healthy children. Before proceeding to inferences, however, it will be advisable to sum up the general purport of the figures in a series of propositions, as follows:—

1st. A very large proportion (93.99 per cent.) of those examined showed more or less follicular change in the palpebral conjunctiva. Trachoma, on the contrary, was distinctively rare, since it was demonstrated in 0.46 per cent. of the scholars only.

2nd. There was no material difference in these respects among boys, girls, and infants. To put the matter in another way, neither age nor sex appeared to affect the result.

3rd. The results obtained by the comparison of boarding and of day-schools agreed closely.

4th. Geographical position appeared to exercise no particular influence over the occurrence of the follicular granulation.

In the light afforded by this investigation, we may next attempt to answer two important questions, viz.:—First, Does the follicular granulation constitute the initial stage of trachoma? Secondly, What is the cause and meaning of that peculiar conjunctival overgrowth?

The follicular granulation, as more than once pointed out, has been regarded by many writers as the early or premonitory stage of trachoma. This opinion, so far as I can gather, is the result of mistaken inference from observed facts. No doubt, a follicular lid has often enough become trachomatous, but that proves nothing in itself, since practically any conjunctiva may become infected by that specific ailment. The deduction has nevertheless been drawn that the one condition predisposes to the other, even if it does not form its primary phase. Then, again, the external resemblance between the vesicular and the sago-grain granulation has led many into the belief

that the one constituted an early stage of the other. The various steps of this transformation appear to have been framed by writers to fit their original assumption. The two conditions have in this way been linked together as indispensable antecedent and consequent, an error not wholly exploded at this moment.

The present figures, however, lend no support to any such view. On the contrary, they show that the follicular granulation was found among all kinds, sorts, and conditions of children; so that if it really constituted an early stage of "granular lids," the latter affection, instead of being comparatively rare, would be one of the most common eye disorders to be met with in this country.

In order to give the reader some idea as to the frequency of trachoma, I quote the following figures, for which I have to thank the gentlemen whose names appear in the table (No. 5).

TABLE NO. 5.

PLACE.	NAME of Observer.	PERIOD.	TOTAL Number of Ophthalmic Patients.	TRACHOMA.	
				Number.	Perc'ntage
(a) ENGLAND AND WALES.					
Manchester Royal Eye Hospital	A. Hill Griffith	12 years	192,296	1,624	0.84
Bath Eye Infirmary	W. M. Beaumont	Nov. 3, 1888, to May 19, 1894.	10,000	73	0.73
Sheffield General Hospital	Simeon Snell		5,500	40	0.72
Maidstone—Kent County Ophthalmic Hospital	Percy T. Adams	1863-1893	74,393	733	0.98
Bradford Eye Hospital	Adolph Bronner	10 years	29,961	142	0.47
Cardiff Infirmary and Dispensary	Tatham Thompson	11 months	1,880	15	0.79
Oxford Eye Hospital	R. W. Doyne*	7 years	12,000	21	0.175
Birmingham—Queen's Hospital	Priestley Smith	10 years	19,346	98	0.50
Eye Hospital	Henry Eales	2 years	37,004	51	0.13
(b) SCOTLAND.					
Edinburgh—Royal Infirmary Dispensary	G. A. Berry		46,320	305	0.65
Glasgow Eye Infirmary	Freeland Fergus	1850-1894	222,636	1,586	0.712
Dundee Eye Institution	A. M'Gillivray†	1893-94	3,983	58	1.45
(c) IRELAND.					
Dublin—National Eye and Ear Infirmary St. Mark's Hospital	H. R. Swanzy A. H. Benson	1 year 13 years	1,981 64,223	66 2,494	3.33 3.88
Belfast—Royal Hospital	Joseph Nelson	1885-1894	5,136	119	2.31
Children's Hospital		1886-1894	2,618	32	1.22
GRAND TOTALS,	· · · ·		729,277	7,47	1.022

* Mr. Doyne remarks that of the 21 cases shown in the Table, at least 9 were imported into Oxford.

† Dr. M'Gillivray writes, "I may state that in Dundee we have a large Irish population, and a good number of Jews. The above cases have been almost exclusively found among them."

The figures show pretty conclusively that, excluding Ireland, trachoma is by no means a common affection in the Ophthalmic Hospitals of England and of Scotland. To be precise, it forms 0·72 per cent. only of the total patients. Would this be the case if the follicular granulation—shown to exist in upwards of 93 per cent. of presumably healthy children—really formed an early stage of trachoma? The reply must, I think, be a decided negative.

Passing from these considerations to the results of actual experience, it may be stated that, after nine years' close observation of children, healthy and otherwise, I possess no evidence whatever to show that, in the absence of an outside contagion, folliculosis ever runs on into trachoma. I have followed the progress of hundreds of subjects for years together, and have satisfied myself that in the vast majority of cases the palpebral outgrowths remained at the end of the period as they were at its beginning. I am firmly convinced that although a school may be packed with instances of folliculosis, yet no mischief will ensue as long as the importation of contagious eye affections is prevented.

One may reasonably conclude, therefore, that the one condition does not constitute an initial stage of the other.

There can be no doubt, however, that the "false" granulation is in practice often mistaken for the "true," "sago-grain," or trachomatous granulation, an error that has led on more than one occasion to endless annoyance, alarm, and expense. Apart from this, one great difficulty in making the differential diagnosis between folliculosis and trachoma, is the fact that the specific processes of the last-named malady attack the follicles as well as the other parts of the palpebral conjunctiva. For example, it is not uncommon to see true "sago-grains" flourishing luxuriantly in the outer part of the lower and at the corners of the upper lids, and along the anterior edge of the superior culs-de-sac. It thus comes about that many cases of trachoma show well marked "sago-grains," occupying precisely those positions affected by the "vesiculo-grains" of the other disorder. Under such circumstances, the diagnosis must hinge partly upon the

naked eye characters of the growth, and partly upon the associated signs and symptoms.

It may serve a useful purpose, accordingly, to give in synoptical form the main points of contrast between these two kinds of conjunctival growth.

THE FALSE OR FOLLICULAR GRANULATION.

1. Oval or roundish, transparent bodies, the diameter of which seldom or never exceeds 1 mm. or 1.5 mm. They often possess a faint yellowish hue, and are usually arranged in rows. Their tendency is to remain discrete, that is, separate from one another.
2. Seldom associated with much structural change in the conjunctiva.
3. Papillary hypertrophy of upper lid never anything more than trivial.
4. Tarsus never implicated.
5. Innate tendency to spontaneous disappearance of growths, without consequent scar-changes.
6. Not accompanied by drooping of the upper lid.
7. Never results in pannus or in corneal complications.
8. Never induces trichiasis, entropion, or shrinking of the culs-de-sac.
9. Occurs chiefly, though not exclusively, in persons under 20 years of age.
10. Not contagious.

THE TRUE OR "SAGO-GRAIN" GRANULATION.

1. Round, opaque, ill-defined bodies, of greyish-white colour, and extreme friability. Firmly and deeply embedded in the conjunctiva, their diameter not infrequently reaches 2 mm., or more. Their tendency is to become confluent, thereby forming tracts or areas of trachomatous material.
2. Always larger and more numerous in the upper retro-tarsal fold than elsewhere.
3. Structural changes always present.
4. Marked papillary hypertrophy of upper lid present in many, perhaps in most, cases.
5. Tarsus often involved in the disease.
6. Spontaneous cure comes about, it is true, but only with onset of scarring, which may be slight or extensive, according to the grade of development reached by the original granulations.
7. Drooping of the upper lid an almost constant sign.
8. Pannus or ulcers of the cornea met with at some period of their life history in at least 25 per cent. of the cases.
9. Not infrequently leads to trichiasis, entropion, or shrinking of the culs-de-sac.
10. Conditionally contagious.

In 1862, Marston published his famous conclusion, namely, "*That the true vesicular ophthalmia has an intimate etiological relation with other miasmatic disorders, and that the state of the conjunctiva offers a delicate test of the hygienic state of a regiment.*" His dictum, as we have seen, has been widely adopted since that time ; it has passed, indeed, into a commonplace of ophthalmology.

If his theory be correct, it stands to reason that one ought to meet with the follicular granulation more frequently in poor than in medium, and in medium than in high-class schools. This comparison is made in the following table :—

TABLE NO. 6.

CLASS OF SCHOOL.	NUMBERS.			PERCENTAGES.		
	No Changes.	Follicular Granulations.	Trachoma.	No Changes.	Follicular Granulations.	Trachoma.
" Good " (584), .	35	549		5.99	94.01	
" Medium " (2459),	135	2,320	4	5.49	94.35	0.16
" Poor " (11,754),	651	11,039	64	5.54	93.92	0.54

The table shows a remarkable correspondence among the three classes, not only as to the " healthy " lids, but also as to those with the follicular granulation. In the case of trachoma, however, it gives a percentage which, commencing at zero in good class schools, rises to 0.16 in medium, and to 0.54 in those of poor class. It need scarcely be said that these figures lend no support to the theory in question.

In order to check the foregoing result, it will be advisable to divide the whole of the schools into two classes :—(1) the four good class schools, viz.—Epsom, Leatherhead, St. Edward's, and the Dragon school ; and (2) the remainder. The figures thereby obtained come out as follows :—

TABLE NO. 7.

CLASS OF SCHOOL.	Number Examined.	No Changes.	Follicular Granulations.	Trachoma.
Public, . . .	584	5'99	94'01	
Remainder of Schools,	14,213	5'53	93'99	0'48

Table No. 7 brings into prominence the fact that there is no particular difference as to prevalence of the follicular granulation between the two classes.

If an insanitary environment lay at the root of folliculosis, that condition might conceivably be more common among town than among country scholars. The next table, accordingly, makes this comparison :—

TABLE NO. 8 (excluding Public Schools and Orphanages).

	Number Examined.	No Changes.	Follicular Granulations.	Trachoma.
Country Schools, .	4,572	3'85	95'87	0'28
Town Schools, . .	9,088	6'35	93'07	0'58

Although there is a difference with regard to the percentage of "healthy" lids, yet the advantage, contrary to expectation, lies with the town children. The difference, however, amounts to 2'5 only, so that it is scarcely marked enough to warrant any definite conclusion.

If mere aggregation of numbers were concerned in the production of folliculosis, it seemed possible that some suggestive results might be obtained by comparing large with small schools. 300 has been taken as the dividing line between these two classes, and cast into tabular form, the figures come out as follows :—

TABLE NO. 9.

SCHOOLS.	Totals.	No Changes.	Follicular Granulations.	Trachoma.
Containing less than 300 Scholars, . . . (16)	3,060	6.31	93.16	0.53
Containing upwards of 300 Scholars, . . . (18)	11,737	5.43	94.12	0.45

It is thus apparent that no notable difference exists between the schools that contain upwards of 300 and those accommodating smaller numbers.

Lastly, if Marston's hypothesis were based upon solid fact, one ought assuredly to find a direct connection between the frequency of the false granulation and the sanitary condition of particular institutions. Yet a reference to the general table (No. 1) will show that the change was just as common in the best as in the worst schools. In fine, I have failed to trace any connection of the kind.*

From the foregoing facts and figures we may, I think, arrive at four conclusions as to follicular granulation. The first is that no noteworthy difference exists in the relative frequency of the condition amongst schools of good, of medium, and of poor social status. The second is that, although offering some points of contrast, the figures drawn from town and country schools are nevertheless not sufficiently divergent to warrant definite conclusions. The third is that aggregation, taken by itself, does not materially

* Since the above was written, I have examined the Sandringham School, at Southport, a high-class institution where the lads are, for the most part, resident. It contained 49 boys upon the occasion of my visit. Of that number, one alone possessed a conjunctiva free from follicular granulation, while the remainder showed changes, often of a marked kind. It is important to note, however, that not a single instance of trachoma was discovered. The scholars—whose ages ranged between 9 and 17 years—were the sons of merchants, of professional men, and of other well-to-do classes; two-thirds of them came from Southport and its neighbourhood, the rest from various parts of the kingdom. It should be added that the hygienic arrangements of the school are exceptionally good, and that no history could be obtained of a single case of acute ophthalmia.

influence the result. Lastly, that no connection can be traced between the sanitary surroundings of individual schools and folliculosis.

It is a familiar observation that well marked and numerous follicular granulations may be met with in children, who, to all outward appearances, are in perfect health. I am convinced in my own mind that the palpebral growths are neither more common nor better marked in unhealthy than in healthy subjects. The advocates of Marston's theory appear, then, to have been driven by the stern logic of facts into a somewhat curious and untenable position. Thus, they endeavour to brush aside the foregoing objection by saying that the follicular granulation merely indicates imperfect hygienic surroundings, and that it has no value whatever as a test of the general well-being of the individual. Their view—which is supported, so far as I know, by no analogy in any other part of the body—proves far too much, inasmuch as it implies that the health is not likely to suffer when the environment is defective, or, rather, that the only part to manifest evil results is the palpebral conjunctiva. The notion, in my opinion, is a mere verbal subterfuge, framed to meet the difficulties of the case.

These facts appear to me to negative Marston's theory, and lead me to the conclusion that the mere existence of the follicular granulation is not satisfactorily shown to be any test whatever of hygienic conditions.

So far, it will be noticed, the frequency of folliculosis has alone been considered, and nothing has been said as to its development in particular cases. It has, in other words, been regarded in its quantitative and not in its qualitative aspect. The latter, of course, is of importance, so that a few words may be devoted to it.

In some of the schools examined, an attempt was made to differentiate slight from marked follicular changes. The division was purely arbitrary, and hence open to more than one source of fallacy. For example, it was difficult—nay, impossible—to preserve a uniform standard of comparison among the different schools. Borderland cases (if the expression may be permitted) that might in one in-

stance be classed as "slight," might upon another occasion be scheduled as "well marked." The figures, therefore, are open to grave objections, and conclusions should be based upon them cautiously, if at all. Their interest lies in the broad, general fact that they afford some practical indication of the degree of change.

TABLE NO. 10.

NAME OF SCHOOL.	No. with Follicular Granulations.	Slight.		Prominent.	
		No.	Percentage	No.	Percentage
Seamen's Orphanage, . . .	275	150	54.55	125	45.45
Crossley Orphanage, . . .	243	206	84.77	37	15.23
St. Edward's, Oxford, . . .	90	54	60.00	36	40.00
Epsom College, . . .	206	175	85.00	31	15.00
Dragon School, Oxford, . . .	56	35	62.50	21	37.50
St. John's, Leatherhead, . . .	197	147	74.62	50	25.38
Walton National School, . . .	282	206	73.05	76	26.95
Walton Board School, . . .	1,518	954	62.84	564	37.16
St. Saviour's, Liverpool, . . .	549	417	75.96	132	24.04
St. Stephen's, Ealing, . . .	58	49	84.48	9	15.52
Edmonton Board School, . . .	2,773	1,960	70.68	813	29.32
Central Foundation Schools of London,	1,101	762	69.21	339	30.79
Gravesend Higher Grade School,	369	297	80.49	72	19.51
Willesborough Board School, . . .	301	198	65.78	103	34.22
Grassendale School,	55	47	85.45	8	14.55
TOTALS,	8,073	5,657	72.63	2,416	27.37

The table (No. 10) shows, then, that of the 8,073 children with follicular granulations, the condition was slightly marked in 5,657, and prominent in 2,416; that is to say, 72.63 per cent. belonged to the first, and 27.37 per cent. to the second class. We shall not be far wrong, therefore, if we state that about one-quarter of the whole number manifested follicles that would be apparent even to an unskilled observer.

A further analysis makes it clear that there was no great difference in these respects among the three classes, viz.—boys, girls, and infants. For example, marked changes were present in 26·46 per cent. of the first, in 33·90 per cent. of the second, and in 32·45 per cent. of the third group.

In view of the fallacy already insisted upon, it seems scarcely worth while to proceed to any formal comparison between groups or classes of schools. Still, the figures may be given in abstract, if only to show that they lend no colour to Marston's hypothesis. (a) *Boarding v. Day Schools*.—The former had 70·24 per cent. slight, and 29·76 per cent. prominent follicular granulations ; while the latter had 74·22 per cent., and 25·78 per cent. respectively. (b) *Good, Medium, and Poor Schools*.—Follicular granulations were slight in 70·53 per cent. of the first-class, in 72·25 per cent. of the second class, and in 74·03 per cent. of the third class ; they were prominent in 29·47 per cent. of the good, in 27·75 per cent. of the medium, and in 25·97 per cent. of the poor schools.

Having thus shown what the follicular granulation is not, our next step will be to enquire what it really is, and what amount of importance must be attached to its existence in particular instances.

At an early stage of my work among the "children of the state," I was struck with certain appearances and conditions frequently associated with ophthalmia. In the first place, I noted that a majority of patients showed some signs of general glandular swelling. It was, however, rare for the enlargement to attain any great size ; as a general rule, the glands were appreciable to touch, and that was all. The groups chiefly affected were those most accessible to palpation, namely, the cervical, the femoral, and the axillary series. In the next place, I observed that a certain number of patients had a soddening of the delicate skin at the angles of the mouth, a state of things now and then complicated by actual dermatitis of those parts. Then, some degree of tonsillar hypertrophy was a common sign, and post-nasal adenoids, too, were far from infrequent. It was also noticed that the mucous membrane of the pharynx was often studded with discrete or confluent nodules, and veined by numerous vessels

coursing around and between the outgrowths. The last-mentioned change struck me as suggestive, mainly because of the resemblance between the granular pharynx, on the one hand, and the "granular" conjunctiva on the other. Indeed, making due allowance for the difference in size of the parts concerned, one condition was the counterpart of the other. Thus, in both the granules were of rounded or oval shape, and of whitish or greyish hue; in both the mucous membrane was now pale, now reddened; in both enlarged vessels were prominent.

To give the reader some idea as to the frequency of these conditions, the following figures may be adduced, dealing with 426 patients:—

Glands.—Cervical, femoral, and axillary enlarged in 316 cases, that is, 68·00 per cent.

Pre-auriculars affected in 290 patients, that is, 68 per cent.

Tonsils enlarged in 260 instances, that is, 61·03 per cent.

Macerated mouth angles in 48, that is, 22·53 per cent.

Gums swollen in 48, that is, 22·53 per cent.

Pharynx granular in 292,—that is, 68·54 per cent.

It seemed possible that a common cause was responsible, not merely for the conjunctival outgrowths, but also for the enlarged glands, the macerated skin, the swollen tonsils, the adenoids, and the granular pharynx.

Accordingly, I made a point of examining the inmates of the school generally, that is to say, those of them who were not suffering from ophthalmia. No extended inquiry was needed to show that the changes named were relatively as common among this class. At that early period of my experience, I inclined to the view that the conditions of life prevailing in such institutions lay at the root of the matter. That opinion, however, was shaken ere long; inasmuch as I discovered that many of the candidates presented for admission to the school suffered from the granular pharynx, while not a few manifested one or other of the remaining signs. A train of reasoning, identical with that referred to in an earlier part of the present paper, led me to surmise

that the pharyngeal condition, at all events, was by no means uncommon outside the walls of parochial schools, even among those living under good conditions of life. Since then, that view has been confirmed by the examination of many children, drawn from various social grades, and belonging to both sexes and to all ages. In short, the outcome of this particular inquiry has been to show that there exists a general correspondence between the state of the pharynx and that of the conjunctiva; those with well marked folliculosis have, as a rule, a similar state of the pharynx, sometimes associated with post-nasal adenoid growths.

It is well known that the activity of adenoid tissue, and of structures largely composed of that tissue, is at its maximum during early life, and lessens with advancing age. The thymus, the lymphatic glands, and the various mucous and serous membranes are instances in point. The thymus, which consists essentially of adenoid tissue, is large in size and of great functional activity during foetal life. During the first two or three years of childhood it becomes progressively larger, and then, after a varying period, during which it remains stationary, it undergoes atrophic change, to be ultimately replaced by fat. The functions of the thymus are still shrouded in mystery, but its structure, together with the analogy to be drawn from animals lower in the scale of creation, seems to show that it acts as a true lymph gland during the earlier years of life. The solitary glands,* and Peyer's patches present a somewhat similar life history. Both structures are made up of lymphoid tissue, and apparently discharge haemopoietic functions in early life, while later on they become less prominent, even if they do not disappear altogether. Again, it is known that the serous membranes of young animals contain much

* I find that the analogy between the vesicular granulation and the solitary follicle has been noted by more than one writer. Welch, for example, penned in 1869 the following words:—"The structural identity of these follicles with the closed follicles of the intestines was pointed out as early as 1860 by Staff-Assistant-Surgeon Frank. Glands in nowise to be discriminated from them," he continues, "can be observed studding the upper part of throat and pharynx occasionally in chronic diseases of the tonsils" (footnote, page 447, *loco citato*). More recently, Durr (of Hanover) has drawn a parallel between trachoma and follicular catarrh of the pharynx (*Ueber die Verbindung von Ophthalmia und Angina Granulosa*).

adenoid tissue, which is ultimately absorbed or converted into fat, while a similar observation is probably true also of the mucous membranes. In short, it may be laid down as a general law that the "adenoid processes" attain their greatest activity in early youth, after which period they undergo a gradual atrophy.

From these various considerations it seems reasonable to suppose that folliculosis should be regarded simply as an outward and visible expression of adenoid activity; or, in other words, that a certain development of follicles is to be looked upon as strictly physiological in young subjects. Individual differences may possibly be correlated with congenital variations of functional activity. Some persons, for example, may have but a slight glandular activity, and in them the palpebral outgrowths will be correspondingly small; while in others the reverse may be the case. In accordance with the law stated above, we should expect, if this view were correct, that folliculosis became less and less marked with advancing years. As a matter of fact, I feel convinced from what I have seen, that this is really the case, but, so far at any rate, I am not in a position to adduce precise figures in support of that opinion.

Whatever be the true explanation of the origin of the follicular granulation, two points stand out clearly from the present inquiry. The first is, that more or less follicular enlargement is the rule and not the exception among children, be they healthy or otherwise; the second is, that individual differences with regard to the degree of its development are commonly observed.

A word as to the life history of the growths, which seem, upon the whole, to remain stationary for long periods, a fact that I have repeatedly demonstrated to my own satisfaction as regards particular children. Should the eye, however, become inflamed—as for example, from injury, foreign bodies, ulceration of the cornea, episcleritis, phlyctenular affections, and the like—they swell up, in common with the conjunctiva upon which they lie. This degree of inflammatory prominence, as a rule, is proportionate to their earlier development, and when the exciting cause has been removed, they return to their former condition. Lastly, as stated before, it

seems probable that they disappear more or less completely in adult life.

The tendency of systematic medicine is to resolve larger into smaller groups, to classify and to sub-divide disease. Many examples of this devolution, so to speak, lie ready to hand. It is a matter of common knowledge, for instance, that chancres and gonorrhœa were in former times believed to be due to a single virus. The experiments of Benjamin Bell, of Ricord, and of others, showed, however, that constitutional syphilis and gonorrhœa were distinct affections, while later investigations by Bassereau proved that the various kinds of chancre possessed a very different significance. Scientific advance has thus resolved into three separate pathological entities a group of maladies once classed under a common heading. Again, chicken-pox and small-pox were at one time regarded as the outcome of a single *contagium*, differing only in the severity of its manifestations. It was found, however, that the presence of varicella did not render a patient insusceptible to the specific poison of variola, and that the one affection sometimes followed closely upon the other in a single individual. From a consideration of these and of other facts—that need not be further specified—it became evident that, notwithstanding a superficial resemblance, the two ailments were essentially different. To take another familiar instance, it was formerly believed that “exanthematic” and “abdominal” typhus (to use the old nomenclature) were one and the same disease, differing only in the fact that the latter was the more complicated variety. It was reserved for the genius of Murchison to throw into their true perspective the distinctive characters of typhus and of typhoid fever, as they are known to us at the present day.

A similar devolution, it will be perceived, has gone on in regard to the conjunctival disorders characterised by the presence of “granulations.” Their history, roughly sketched in, is as follows:—At the beginning of the present century, the prevalence of so-called Egyptian ophthalmia directed the attention of many observers, both in this country and abroad, to the palpebral outgrowths. Next, authors

noted the difference between papillary and other conjunctival granulations, all of which were regarded, however, as significant of serious disease. Then writers—for the most part army surgeons—began to draw a distinction between the small transparent vesicle, and the larger “sago-grain” granulation, and taught that the follicle constituted the initial stage of the “sago-grain,” and that it indicated an imperfect sanitary environment. Next, it was held that the vesicle and the “sago-grain” had nothing in common; that they were, in short, two separate and distinct pathological conditions, differing in their origin, in their course, and in their terminations. It is now suggested that a certain grade of vesicular enlargement is, practically speaking, common to all children, and, further, that it should be looked upon as a natural outcome of the high functional activity of their adenoid metabolism.

The following conclusions as to follicular granulation may, I think, be fairly drawn from the facts and figures brought forward in this paper :—

1. In man—as in many of the lower animals—the so-called follicular granulation is visible to the naked eye. It is present, to an extent that varies with the individual, in almost all persons under twenty years of age.
2. It does not constitute the initial stage of the specific disease, trachoma.
3. It is not satisfactorily proved to be the immediate and direct outcome of an unhealthy environment. It cannot, therefore, be regarded as any index to the nature of the surrounding sanitary conditions.
4. The evidence that it predisposes to trachoma is by no means decisive.
5. The follicular granulation forms in all likelihood an expression of what (for want of a better name) may be termed the “adenoid activity” of young subjects. It is strictly comparable with the follicular projection of the pharynx, and, also, with the solitary follicle of the large and small intestine.

THE TREATMENT OF TRACHOMA AND OF ITS COMPLICATIONS.

INTRODUCTORY SKETCH.

A GLANCE at the early history of trachoma shows that the systematic treatment of the disease has been carried out from a remote period. Thus, Hippocrates—the Father of Medicine—advised scarification and excision of the “granules,” followed by the actual cautery. It appears, indeed, that removal of the growths by energetic friction (*Blepharoxysis*) was a routine method of treatment among the ancient Greeks. Celsus scraped the thickened conjunctiva with a fig-leaf or with a roughened surgical instrument, while Paulus *Ægineta* used pumice stone or the bone of a cuttle fish for the same purpose.*

Other writers of antiquity might be readily quoted, but the foregoing instances will suffice to show that mechanical means of cure have been employed well nigh from time immemorial.

Passing now to the commencement of the eighteenth century, we find concise directions for the surgical treatment of trachoma laid down by various writers. Sir William Reed, in his curious and interesting book,¹²³ said that if the excrescences be “thick and gross” they “must be cut away with the point of a launcet.” Woolhouse, oculist to James II. and to William III., adopted the extreme method of scarifying the conjunctiva with barley ears. The same empiric also invented an instrument, the *xystrum*,¹²⁴ which he used for a similar purpose. Benedict Duddell, who wrote

* In some countries these ancient practices have been handed down to the present day. Thus, the Bulgarian¹²⁰ and the Turkish peasants¹²¹ treat granulations by friction with leaves. The Greeks,¹²² again, use some rough substance, such as a piece of sugar, and then cauterise the wound with flowers of sulphur.

in 1729, was a warm advocate of scarification, which he recommended for almost all inflammatory conditions of the eye. Like Woolhouse, he carried out the operation in the case of trachoma by means of a brush made of barley beards. In short, during the whole of the last century, fern bulbs, pumice stone, metallic rasps, and other agents of the kind were commonly used in the treatment of "granular lids."

About the year 1802 the attention of surgeons was forcibly drawn to the existence of the malady. At that time the British troops had lately returned from their Egyptian campaigns. Many of the soldiers were blinded from the effects of ophthalmia, while a still larger number came back with the disease in an active condition. Under such circumstances, it was not surprising that outbreaks of ophthalmia soon made their appearance in various parts of England, Ireland, and Scotland—in fact, wherever the troops in question were quartered. The soldiers on their voyage home, moreover, conveyed the disease to foreign stations at which they touched. At Malta, for instance, ophthalmia was in the first place communicated to several women with whom the soldiers associated (Vetch),⁹⁶ while at Gibraltar it became established as a garrison epidemic.

Meanwhile ophthalmia spread in Great Britain to an alarming extent. In 1804 it was communicated to the Irish Militia by regiments from Egypt, and also broke out in the 2nd battalion of the 52nd regiment, then stationed at Hythe. The battalion which it attacked was composed of volunteers from the Irish Militia, not one of whom had been employed in the Egyptian campaign. In 1806 ophthalmia ravaged sections of the 43rd and 95th regiments, quartered at Hythe. Somewhat later, it affected other army corps, and prevailed with particular violence in the 29th, the 54th, and the 89th regiments. So serious did it become that the authorities found it necessary in 1807 to erect three hospital stations for the reception of soldiers afflicted with ophthalmia. A year later, these establishments contained, according to Vetch,⁹⁶ no less than 900 cases, drafted from forty different army corps. On the 1st of December 1810, the military hospitals at Chelsea and Kilmainham

sheltered 2,317 soldiers who had been rendered blind by ophthalmia, to say nothing of many others who had lost the sight of one eye only.

Ophthalmia did not by any means confine its ravages to the troops. It rapidly invaded the civil population, and appeared in various large establishments, such as for instance, the Royal Military Asylum at Chelsea, where 1,140 children were lodged and educated.

Abroad, this scourge attacked the European armies far and wide. Two-thirds of the French soldiers, according to Assalini,¹²⁵ had ophthalmia at one time ; and it is a matter of common knowledge that the affection spread to the troops of Prussia, of Russia, of Belgium, of Austria, of Sweden, and of Denmark.

All kinds of epidemic eye disorders were no doubt included under the generic name of "Egyptian Ophthalmia." Many of the cases were probably of gonorrhœal origin, and as the connection between ophthalmia and blennorrhagia was then practically unrecognised, it is likely that the virus would be spread by such conditions as the common use of towels, and by sleeping more than one in beds and hammocks. Trachoma, again, played an important part in the outbreaks, although the disease assumed a more acute form than is now usually the case. That trachoma lay at the root of the matter may be inferred, however, from the fact that the ailment lasted for so long a period, and clung so persistently to certain regiments. Moreover, the acute cases were often followed by a train of chronic symptoms, that, to judge from contemporary authors, tallied closely with trachoma as observed in our own day. In endeavouring to form a clear idea of the scientific history of the disease at this period, it is important to note that the contagious nature of ophthalmia was not at first recognised. In 1806, however, that vital point was insisted upon by Edmonston,¹²⁶ whose views were endorsed later by Vetch and others.

Blood-letting, even to syncope, was then the sovereign remedy, and it was not unusual to take away from a patient as much as sixty ounces of blood at a sitting. Indeed, the practice was pursued to an extent

hardly credible in these days. Peach,¹²⁷ surgeon to the 52nd regiment, placed the prevailing method in a nutshell when he advised a brother practitioner "not to be guided by the quantity of blood abstracted, but to produce syncope in all, and as often as he found recurrence of pain, so often must he have recourse to the lancet." Shortt, who had much experience of ophthalmia, both in Egypt and in Sicily, removed in some instances as much as 200 ounces of blood. He made the significant statement, however, that he was often unsuccessful, not only in checking the disorder, but even in lessening its severity. Modern practitioners will readily understand why Shortt's methods were not invariably crowned with success.

Although at this period phlebotomy was the main remedy, we nevertheless find that the surgical treatment of the conjunctiva itself was by no means neglected. That enlightened observer, John Cunningham Saunders,¹²⁸ treated inveterate forms of trachoma by excision of the granular membrane, and prevented subsequent growth of morbid material by the frequent use of a solution of alum or of silver. It is both interesting and instructive to observe that Saunders recognised the relation of certain opacities of the cornea to diseased conditions of the lids. In 1811, Farrell¹²⁹ stated that he had occasionally met with cases of ophthalmia in which inflammation was kept up by "small, hard, and rough tumours in the conjunctiva lining the eyelids," and he recommended removal of the growths by dissection. He also advocated the withdrawal of from 30 to 50 ounces of blood within the first twenty-four hours of the onset of the acute disease.

In the year 1812 we touch upon a curious incident in the history of trachoma. William Adams, an oculist in civil practice, volunteered to treat by "a new method" cases of Egyptian ophthalmia among the inmates of the Royal Hospital for Seamen at Greenwich. His offer excited a vivid interest, both in medical and in military circles. A house was taken in London, whither the pensioners were sent to undergo Adams's special methods of treatment.

The official papers,¹³⁰ drawn up by the medical officers of Greenwich Hospital, and published by authority in 1814, claimed an

absolute success for the new plan. The pith of the report may be gathered from the following extracts:—"We think it our duty to state, for the information of the Board, that Mr. Adams has discovered a mode of curing the Egyptian ophthalmia, which has been successfully practised on several of the pensioners, some of whom had been blind for three or four years, and given up as incurable by the most eminent oculists then in London . . . that the promulgation by Mr. Adams of this important discovery be considered as a great national desideratum. By the adoption of his practice, we are of opinion, from what we have seen of its effects, that a very large proportion of the seamen and soldiers who have been discharged the service blind of the ophthalmia might be again rendered fit for duty, or be made useful members of society."

An embittered controversy, however, speedily arose as to the value of his treatment, which merely consisted in paring away granulations by means of a knife. The following occurs in a report¹³¹ signed by M'Grigor and by Franklin, and presented to His Royal Highness the Commander-in-Chief in 1819:—"In regard to Sir William Adams's treatment of chronic diseases of the eyes . . . we are unable to state that he has adopted a more successful method of treatment than other persons: on the contrary, we consider his practice to have been in the main unsuccessful, and we have little doubt that, if a certain number of cases of chronic ophthalmia, and particularly opacities of the cornea and granulations of the lids, were to be placed under Sir William Adams, and an equal number of similar cases under the charge of medical officers of the army, that the medical officers of the army would cure or benefit a larger proportion of them than Sir William Adams."

In short, a perusal of the evidence^{118, 132, 133} makes it plain that Adams's so-called new methods were merely those of his tutor, Mr. Saunders, adopted without the slightest acknowledgment. The only claim to originality that can be conceded to him is that he employed a knife where Saunders had used a pair of scissors. Nevertheless, he managed to secure a knighthood, and a few years later we read that a proposal was made to grant him £4,000 from the public funds.¹³⁶

The treatment adopted by Benjamin Travers⁵⁴ for "granular conjunctiva" may be given in his own words. "The lid should be everted," he wrote, "and the projecting granules shaved off from the surface and orbital edges of the tarsus with a keen-edged lancet, or if peduncular and prominent, they will be more conveniently snipped off with the flat scissors" (p. 271).

So far, the practice of British surgeons has alone been considered; but a cursory glance at foreign literature will show that the use of operative measures in trachoma was by no means confined to these islands. About this period, for instance, many continental surgeons practised scarification of the lids and partial excision of diseased conjunctiva. The German oculist, V. Walther, stood out prominently as an advocate of such measures. His plan was to remove a large piece of the conjunctiva, and he claimed great benefit from the treatment, not only in chronic, but also in acute forms of the disease. Rust, Eble, and Gouzée were in favour of surgical interference, but not to the exclusion of other means of treatment. During the first few decades of the present century, then, operative methods enjoyed considerable vogue, both at home and abroad.

Before long, however, the escharotic treatment of trachoma sprang into prominence. MacGregor,⁴⁷ surgeon to the Royal Military Asylum, recommended that method in the year 1812, and laid especial stress upon the advantages possessed by lunar caustic. Indeed, in the August of that year the following departmental note, signed by the Deputy-Inspector of Hospitals, was circulated among the military surgeons in the Kent district:—"A solution of ten grains of nitrate of silver in one ounce of distilled water has been found, in some of the regiments, an excellent application; a drop or two put into the eye every second day."

Vetch,⁹⁶ after a trial of surgical means, declared his preference for copper sulphate, silver nitrate, lead acetate, verdigris, burnt alum, and potash, and laid down a series of excellent rules for the employment of those remedies. It may perhaps be mentioned that, in Vetch's judgment, eversion of the upper lid, as practised by Saunders, was not generally necessary for the cure of the disease. His custom,

which at any rate possessed the merit of simplicity, was merely to raise the upper lid, and to apply the remedies.

O'Halloran,¹⁰⁰ an army surgeon of great experience, dissatisfied with antiphlogistic treatment, used bluestone and lunar caustic in 1824. In point of fact, his line of treatment did not differ materially from that adopted by most surgeons at the present time. The patient was confined to bed in a large and well ventilated ward, from which light and air were not excluded; he was placed upon spoon diet, and purged with calomel and colocynth, and afterwards with salts. Bluestone in substance was rubbed over the upper lids for a longer or shorter time according to the state of the conjunctiva, and the application was followed by fomentations repeated four or five times during the course of the twenty-four hours. Next to bluestone, O'Halloran recommended nitrate of silver solution, dropped into the eye each morning. "I have made trial," he wrote, "of lunar caustic solution in different degrees of strength, viz.:—from one grain to half-a-drachm, dissolved in one ounce of water; and after witnessing the effects of all, I gave the decided preference to the ten-grain mixture." His opinion with regard to operative measures may be gathered from the following quotation:—"It is astonishing how quickly the state of the eyelid, denominated granular, is removed by the bluestone, if the subject be not of scrofulous habit, or the eyelids spongy, watery, or covered with fatty dry lumps. In the latter case, the knife will be necessary for the removal of the tumours; after which a solution of bluestone will complete the cure. The case in question is the only one in which, in my opinion, the knife is admissible to the internal surface of the eyelids."

A year later, Dr. T. H. Ridgway¹⁰⁴ published an article in one of the medical journals, and claimed that he had been one of the first to use lunar caustic in ophthalmia; that he had, in fact, inspired the official recommendation of a ten-grain solution in 1812.

In 1828 Alexander Watson¹⁰⁵—a systematic writer on eye disease—laid much stress on the value of escharotic applications to the everted conjunctiva, and urged the claims of agents such as bluestone, lunar caustic, and dilute nitric acid. He condemned the

practice of removing with knife or scissors large granulations, believing that the operation might be followed by inversion of the lid.

Meanwhile, the ravages of ophthalmia among the troops of the low countries had directed much attention to the causes of the malady, and in 1833 we find the Belgian doctors split into two opposing camps, namely, the compressionists and the contagionists. The former—represented by Vlemincks—held that the disease resulted from compression exercised upon the neck and forehead by the tightly fitting accoutrements of the soldiers. The latter—represented by Fallot and by Varlez—taught that contagion was the sole cause of ophthalmia. In order to settle this remarkable divergence of opinion, the Minister of War was constrained to appoint a medical commission, which, although inclined to accept the compression theory, was unable to arrive at a satisfactory and unanimous conclusion. In this dilemma, the Belgian government invited Jungken, of Berlin, to assist in settling the disputed points. A compromise was effected: the cut of the uniform was modified, and it was determined to send to their own homes all soldiers who suffered from palpebral granulations. As a matter of fact, during the last nine months of the year 1834, no less than 4,494 men were thus dismissed. As might be expected, this ill-advised measure was quickly followed by disastrous consequences: ophthalmia spread to the relatives and friends of the discharged soldiers, and made its appearance in places which had up to that time been free from the scourge. The matter was taken up by the press, both lay and medical, and in 1837 the original order was rescinded, and all soldiers affected with ophthalmia were quartered at a special depot at Namur. Later on, additional accommodation was provided at Beverloo and at Ypres.³⁵

In 1839, Gouzée, a Belgian surgeon, warmly advocated the employment of silver in trachoma. He used a concentrated solution of the caustic, the effects of which were mitigated by the subsequent application of oil to the conjunctiva. Hairion, after an extensive experience of the disease, also recommended the use of

silver nitrate in strong solution. Guthrie (the founder of the Royal Westminster Ophthalmic Hospital) treated trachoma by an ointment which contained about eighty grains of the finely pulverised silver salt to an ounce of hog's lard. This preparation, commonly known as *Guthrie's Black Ointment*, was applied directly to the conjunctiva by means of a brush, and the application was repeated daily.¹⁴⁰

It was about this period that attention was directed to the virtues of tannic acid in the treatment of trachoma. Hairion,¹⁴¹ in 1851, extolled the new remedy, which he mixed with mucilage and applied several times daily. "Excision of conjunctiva and paring away the granulations," he wrote, "are rarely useful, and never indispensable to success. On the contrary, these operations are often harmful, because they aggravate the inflammatory symptoms, and give rise to the formation of bands and cicatrices." A couple of years later, Roosbroeck⁵ endorsed the tannic acid treatment, and condemned operative measures in unsparing terms. Hamilton¹⁴² treated granular ophthalmia, whether acute or chronic, by insufflation of the acid, an application that was repeated daily for about five days, and then every other day, until cure was complete. Wolfe and Millingen, also, have used tannic acid in more recent times.

In 1847, Desmarres introduced the mitigated silver stick, *i.e.*, nitrate of silver and nitrate of potassium fused together and cast into convenient shapes for use. He was led to invent this modification, because he found the pure caustic was too powerful when applied to the conjunctiva. A statement has been made that Ignaz Gulz was the inventor of the mitigated silver stick. The fact is, however, that his communication did not appear until 1850, three years after that of Desmarres. Seventeen years later, Guyot¹⁴³ proposed the addition of sulphate of potash in order to render the crayon less deliquescent.

The classical writings of Albrecht v. Græfe,¹⁴⁴ published in the year 1854, placed the escharotic treatment of conjunctival affections on an assured footing, and for a long time surgical methods fell into comparative disuse. Græfe, who preferred the mitigated stick to solutions of caustic, advocated the use of silver in practically all cases, and laid down precise rules for its employment.

Among the few who still practised surgical methods was Pilz.¹⁴⁵ That surgeon in 1854 advised that the granules should be excised from the conjunctiva. His method was to remove one or two of the growths every day until the malady was subdued. It may be noted in this place that Pilz also advocated the extrusion of the gelatinous contents of the infiltrated conjunctiva by pressure. His proposals, reasonable enough in themselves, do not appear to have been generally adopted. In the same year, William Mackenzie¹⁴⁶ recommended local depletion, counter-irritants, and tonics, together with the application of escharotics. In chronic cases, where the granular condition failed to improve under other methods, he advised that the hypertrophied papillæ should be shaved off by means of a small knife, or dissected away with scissors. "In performing this operation," he remarked, "it is necessary to beware of removing more than the mere granular layer. If more than this is taken away, hard and irregular cicatrices are left on the internal surface of the lids, the effects of which on the corneæ may be scarcely, if at all, less prejudicial than those of the morbid structure which has been removed."

Five years later, a suggestion was made of a somewhat different character. Borelli,¹⁴⁶ an Italian surgeon, proposed to remove the morbid material from the conjunctiva by means of a wire brush, the so-called *scardasso*. Similar methods have been recommended since that time by Fadda¹⁴⁷ and by Schroder. The former used a metallic plate, set with rows of teeth, by which he scarified the diseased surface. His instrument produced good results in Professor Paoli's hands. Schroder, as lately as 1889, re-introduced a method essentially similar to that advocated by Borelli in 1859.

In 1866, Dr. William Stokes¹⁴⁸ conceived the idea of curing a granular eyelid by pressure. He accordingly devised an apparatus, consisting of two highly polished ivory plates, curved so as to fit the contour of the conjunctiva. One plate having been inserted between conjunctiva and eyeball, and the other placed on the outer surface of the eyelid, the two were brought together by means of a simple mechanism. At first the machine was applied for an hour

daily, but later on for a longer time. Stokes reported good results in three cases. A few years later, an Italian surgeon, named Albini,¹⁴⁹ went to work in a somewhat similar fashion. He recommended a plate of platinum, which was inserted beneath the eyelids, and retained in place by a bandage. The “*opistoblefari*,” as the apparatus was called, claimed a wide application beyond the mere treatment of trachoma by pressure. The fact should be noted that an Irish medical man—Dr. Robert M'Donnell¹⁴⁸—had previously invented a glass mask, which, inserted between lid and globe, was supposed to fulfil two purposes—viz., to protect the cornea from the friction of the granular lid, and to subject the granulations to a certain amount of pressure.

It would be strange if so universal a remedy as electricity had not been used in the treatment of trachoma. As a matter of fact, in the year 1870, Rodolphi¹⁵⁰ (of Brescia) reported two cases in which he claimed that the employment of electricity had been followed by good results. His method was simplicity itself. The negative pole of a weak constant current was applied to the tarsal conjunctiva by means of a convexo-concave sheet of copper, while the positive pole was connected with the temporal region by means of a sponge moistened with salt and water. A year later, however, another Italian surgeon, named Cadei,¹⁵¹ reported that Rodolphi's method yielded negative results in five patients who had been made the subject of experiment.

An operation variously styled *Periton*, *Syndectomy*, *Circumcision* or *Tonsure of the Cornea*, was introduced in 1853 by Van Roosbroeck*, as a remedy for inveterate pannus. A ring of conjunctiva was removed from the outer edge of the cornea ; or, after a deep and circular incision had been made around that membrane,

* In cases of severe gonorrhœal ophthalmia, Astruc²²² (1754) advised the surgeon “to cut off the border of the swelled conjunctiva all round.” Scarpa,¹⁵⁴ it may be also noted, was in the habit of excising the chemosed conjunctiva of purulent cases with curved scissors. It is an open question, however, whether the credit of introducing periton should not be given to James Ware, who, in the year 1814, recommended circular incision of the conjunctiva in opaque cornea. (“Remarks on the Purulent Ophthalmia,” London, 1814, p. 30.)

solid nitrate of silver was applied to the track of the wound. It was supposed that the resulting scar-tissue would strangle, as it were, the vessels of the pannus, which would then dwindle and ultimately disappear. The procedure was advocated by Küchler at the Brussels Congress in 1857. These facts, however, seem to have been overlooked by Furnari,¹⁵¹ who re-introduced a precisely similar operation in 1862. Since then it has been practised and recommended by many surgeons, notably by George Critchett¹⁵² and by Warlomont, with the latter of whom, indeed, it took the place of inoculation.

Vacher,¹⁵³ in 1886, proposed to replace peritomy by a circular cauterisation made with the hot iron, a practice that has since been adopted by not a few surgeons (Dianoux, Teillais, &c. &c.).

A host of escharotic agents has been used in trachoma. Acetate of lead once enjoyed a large vogue, and a particular method of application, introduced by Buys in 1840, merits separate description on account of its historical interest. Buys¹⁵⁵ noted the good results obtained in venereal warts by the use of the salt, and was led by analogy to adopt a similar plan in trachoma. A brush, barely damped with water, was placed in the neutral acetate, which was then spread over the surface of the conjunctiva, the lid being kept everted until the medicament had been dissolved by the tears. Eleven years later, Gouzée¹⁵⁶ introduced a slight modification. He moistened a small quantity of the acetate with water, and worked it up with a brush into a sort of paste, which he then placed upon the granular surface.

Chromic acid has been extolled both by recent and by older writers. Hairion,¹⁵⁷ in 1858, recommended its use in obstinate cases of trachoma. The acid, mixed with an equal quantity of distilled water, was applied to the everted conjunctiva by means of a small martin's hair brush. Two to fourteen cauterisations, spread over one to four months, were necessary to complete the cure. In 1866, Serres¹⁵⁸ recommended a modified plan, namely, to liquefy the acid by exposing it to air, and then to apply it to the granulations of the upper lid. Richet used the acid in 1868, but was

compelled to abandon it on account of the depth of the resulting scars. In 1886, Darier¹⁵⁹ proposed alternate applications of chromic acid and of sulphate of copper, in cases where the latter alone produced no good result. His underlying idea was that the acid destroyed the superficial tissues, and thus allowed the antiseptic virtues of the copper salt to come into play. Desormais,¹⁶⁰ in the same year, recommended a similar plan, except that he substituted the glycerole of copper for the solid sulphate.

Quinine, as a local application, has not been without its advocates. Thus Bader¹⁶¹ reported eight cases in which that agent had done good. A small quantity of the bisulphate was deposited by means of a dry camel hair brush on the inner surface of each lower lid, and the applications were repeated night and morning. Ruvioli,¹⁶² also, employed quinine in a similar way for the cure of pannus.

Indeed, the number of escharotic and other agents that have been tried in trachoma is well nigh innumerable. The acid nitrate of mercury, the chlorides of zinc and of gold, nascent iodide of silver, liquor potassæ, bichloride of mercury, boroglyceride, tincture of iodine, pyoktanin, copaiba, hydrastin, creolin, alum and sulphate of zinc crayons, phosphoric and carbolic acids, ipecacuanha, and sulphur ointment, have all been employed at one time or another.

In the four decades between 1830 and 1870 we find many writers advocating the inoculation of pus. This method, first brought prominently forward by Frederick Jaeger in 1812, consisted in bringing a drop of matter, taken from a case of purulent ophthalmia or of gonorrhœa, into contact with the conjunctiva of a patient suffering from an opaque and vascular cornea.* The resulting inflammation, which was usually of an intense character, lasted from three

* Although the introduction of inoculation is popularly assigned to Jaeger, yet an Englishman may claim priority, at least as regards the principle involved in the method. Henry Walker, writing two years before Jaeger, on the treatment of vascular cornea, said: "Disappointed by every method hitherto introduced, I endeavoured to make the eye assume the inflammatory action of what has been called purulent ophthalmia, and to this I applied the usual remedy,—venesection. In several cases the practice has proved successful, not a single enlarged vessel remaining at the end of a fortnight" (*Edin. Med. and Surg. Journ.*, 1811, page 5).

to six weeks, and was often followed by more or less complete resolution of the corneal opacity. Piringer, in 1813, employed inoculation on a very extensive scale, and thoroughly worked out the details of its application. The method was widely adopted in many countries. It was used with much success in Belgium by Fallot, Hairion, Van Roosbroeck, Warlomont, and Van Weesemael; in Italy by Torri; in Holland by Kerst and others; in France by Rivaud-Landrau, by Brière, by Panas, by Abadie, by Berthelot, and by Poncet; while in England, Dudgeon, Bowman, Humphry, Lawson, Soelberg Wells, Higgens, Bader, Windsor, Morton, and Hildige, employed it on a more or less extended scale. The last-named writer¹⁶³ went so far as to say that inoculation "may be safely resorted to in every case of granular ophthalmia, except when it is contraindicated by a strumous or syphilitic diathesis, in which cases diphtheritic inflammation would be the inevitable result."

Extended experience showed, however, that inoculation was not without its dangers. For example, the risk of communicating syphilis was a real one, at least when the matter was taken from the urethra. Graefe was forced to abandon the practice, because he found that diphtheritic conjunctivitis often resulted. Further, the cornea sometimes became ulcerated, and eyes were lost. In short, the risks entailed by inoculation limited its employment to a particular class of case, namely, that in which both eyes were affected with complete pannus.

A noteworthy contribution to the list of agents used in the treatment of trachoma was made by De Wecker¹⁶⁴ in August, 1882. He brought into prominent notice the claims of certain seeds derived from the *Abrus Precatorius* or Jequiriti. It appears that a former patient had sent him a specimen of these so-called "prayer beads," which had been for long in common use among the inhabitants of Brazil. Wecker instituted a series of experiments with this novel agent, as the result of which he concluded that a croupous or purulent ophthalmia could be just as readily induced by it as by the older practice of inoculation; further, that the inflammation could be heightened or reduced at will. With this vegetable product

available, Wecker remarked, there could be no longer any excuse for using pus from an individual, about whose constitution one could never feel quite certain.

A few months after Wecker's communication, Moura-Brazil,¹⁶⁵ of Rio Janeiro, published a lengthened account of his experiences with jequirity, which he claimed to have employed for more than a year. The writer was sanguine enough to say that the seeds were destined to enjoy an important place in ocular therapeutics, and that by their aid the treatment of a disease that had baffled generations of practitioners would become a very simple matter. He added, moreover, that Castro Silva, of Ceara, had written a brief memoir on the virtues and properties of the remedy in 1867.

At the end of 1882, Wecker¹⁶⁶ again advocated the claims of jequirity, of which he had made an extensive trial since the date of his former publication. He stoutly maintained that the intensity of the resulting ophthalmia was directly proportionate to the strength of the maceration and to the number of applications; that the cornea ran no special risks; and that the granulations were speedily cured.

The new remedy excited considerable attention in all quarters of the civilised world, and numerous opinions, favourable and otherwise, were soon expressed as to its value. Deneffe, for instance, denied that jequirity exerted any beneficial influence either on trachoma or pannus; and Terrier and Vossius adopted a similar view. Lainati and Teodoro obtained negative results among fifteen male and fifteen female patients. Osio, of Madrid,—who employed an ointment containing about 3 per cent. of jequirity—narrated three instances in which panophthalmitis and perforation and opacity of the cornea had followed its use. On the other hand, Gillet de Grandmont, Dujardin, Mazza, Sattler, Foucher, Ponti, and Chauzeix, claimed that the medicament was a success. Benson¹⁶⁷ used jequirity in about sixty cases, with almost uniformly satisfactory results, both as regards the granular ophthalmia and any pannus that might chance to be present. He found no cases of permanent injury even when the cornea was ulcerated, and he claimed that the Brazilian remedy formed a safe, comparatively speedy, and efficacious

method of treating trachoma. Brailey²⁵¹ had successful cases. Eugene Smith, Howe, Webster, and Derby, reported good results from America.

The discussion became animated on all sides. De Wecker continued to publish eulogistic articles, although it may be noted that he now proposed to limit the use of jequirity to cases of very chronic trachoma, and he entered an energetic protest against its employment in other conditions. Furthermore, he modified to some extent his former statement as to the risk run by the cornea, and said that there was no danger, provided the number of applications was limited, and the strength of the solution was not too great.

The opponents of the method, however, were not by any means silenced. Galezowski and Parisotti condemned jequirity, and expressed their belief that as regards the cure of granulations, its effects were transient and fictitious. Hippel, who denied that the intensity of the ophthalmia bore any relation to the concentration of the solution, several times observed ulceration of the cornea; and Martin, of Bordeaux, lost an eye from a single application of a 2 per cent. solution. Wickerkiewicz employed the powdered grains, and produced ulcerative keratitis. Fust observed a central abscess of the cornea after the use of jequirity. Pollak, although he extolled the agent, recorded the fact that in one instance an eye had been lost after its use. Manfredi treated sixty-nine eyes, and obtained 26 per cent. of cures. One of his patients, however, had both corneæ destroyed, while one other eye was lost after the application of the powdered seeds. Sedan recorded perforations after the use of jequirity, while Coursserant observed ulceration of the cornea and symblepharon. Iritis and affections of the tear passages were also reported.

The divergence of opinion with regard to the value of jequirity was brought out strongly in the reports of the discussions at the various meetings of oculists in France and elsewhere. Thus, at the French Ophthalmological Society in January, 1884, while Coppez, Terson, Vallez, Abadie, Vachez, and Nicati extolled the virtues of the new remedy, Dor, Gayet, Boucheron, and Nicolini denied its efficacy.

The further history of jequirity need not be traced. One may merely remark that its peculiar powers of exciting inflammation, at first believed to be due to a bacillus, are now known to be caused by an unorganised ferment. Of late years little has been heard of the agent, although it is still employed by a few practitioners, apparently with good results.

It may be noted in passing that other means besides pus and jequirity have been used to excite a curative inflammation of the conjunctiva. Thus, von Graefe,¹⁶⁸ with the idea of causing absorption of the morbid material, endeavoured to set up an inflammatory condition of the conjunctiva by the prolonged application of hot fomentations; and an almost identical plan was adopted by Saemisch. Of late years Dr. Aimé Bernard,¹⁶⁹ following the lead of Badal, found that the local application of a 1 per cent. solution of cantharidine gave rise to a species of ophthalmia. He reported favourable results in four cases of trachoma. Santos Fernandez¹⁷⁰ tried the effect in six trachomatous patients of the cantharidate of potash or soda, a remedy which he injected hypodermically. His ultimate results, however, do not appear to have been very satisfactory. Alcon¹⁷¹ used an infusion of tobacco as a substitute for jequirity, but the hyperæmia set up was associated with so much pain, photophobia, and general malaise that he was compelled to forego the treatment. Alcon's experiences recall those of Vetch,⁹⁶ who also employed an infusion of tobacco so long ago as 1820.

The quaint and curious proposals that have been made from time to time for the cure of trachoma and of pannus seem well nigh endless. Goubé, in 1875, used injections of a 2 per cent. solution of carbolic acid beneath the conjunctiva, a method endorsed some eleven years later by a Russian surgeon, Sehjepkin. Experiments conducted in 1887 by Wadsinsky, however, placed this treatment in a very unfavourable light, inasmuch as he found that extensive scars resulted from it, while as regards cure, its effects were negative. Dransart²⁵⁸ has recently advocated the sub-conjunctival injection of corrosive sublimate (1 to 1,000). He reports excellent results. It has been proposed to attack pannus directly by digestive ferments.

Lydston,¹⁷² of Chicago, employed, for instance, a mixture of the *Caricaya Papaya* and boric acid, which he dusted over the cornea. Cheatham¹⁷³ treated trachoma by covering the exposed conjunctiva with a powder containing an extract of the pancreatic gland.

Direct massage of the conjunctiva, together with the use of various powders, has been recommended by many recent writers. Thus, Costomiris¹⁷⁴ covered the diseased membrane with a thick layer of pulverised boric acid, which was then rubbed in by means of the finger. This method was adopted by Vignes, Rohema, Eliasberg, Levesque-Lacroix, Holmes, and Beaumont. Instead of the acid, Delagénière used beta naphthol; Adler and Merge, antipyrine; and Keyser, powdered pumice stone.

Of late years, however, the tendency has been to replace escharotic by surgical means of treatment. The pendulum has swung back; ancient methods have been revived; and many complicated surgical procedures devised for the relief of trachoma.

Excision of the retro-tarsal folds has been recommended by Richet and Galezowski (1874), Giffo (1879), Brachet and Aguilar Blanch (1882), Parizotti (1883), Voukchévitch (1884), Vossius (1885), Alt and Sedan (1886), Jacobson (1888), Elschnig and Dismissas (1889), Treitel (1889), Pfalz, Veszely, and Anfuso (1891), and other surgeons.

Heisrath,¹⁷⁵ dissatisfied with excision of the retro-tarsal folds in cases of severe trachoma, went to the length of removing portions of the tarsus itself.* He did not scruple to excise pieces of the tarsus and adjacent fornix measuring 1 cm. in height and 1.5 cm. in width. Heisrath performed the operation on 230 patients, and claimed excellent results. His procedure was endorsed by Richter, who reported a series of successful cases.

Scarification of the conjunctiva, combined in various ways with "brossage" and "grattage," has been recommended and practised, among others, by Abadie (1891), Manolescu (1891), Darier (1891 and 1892), Giotti, Weeks, and Panas (1892).

* Heisrath's plan recalls one adopted at the beginning of this century by Saunders,¹²⁸ and used by him for the relief of an inverted upper lid. By a curious coincidence, Pope¹⁷⁶ has comparatively lately recommended a similar operation.

Treatment by galvano-cautery has been brought prominently forward by Samelson, Hirschmann (1875), De Wecker and Masselon (1882), Unterharnscheidt (1883), Dehenne (1884), Wickerkiewicz and Frolich (1886), Fieuza (1887), Reiech (1888), and by Hans Adler (1890). The method has been strongly opposed by Just and by Korn.

Kasauro, in 1883, Cecchini, in 1885, and Peunow, in 1888, advocated scraping away the diseased tissue by means of a sharp curette; while a similar treatment has lately been recommended by N. C. Macnamara,¹⁷⁷ in this country, and by Blubaugh in America. Dr. Felix Lagrange¹⁷⁸ has invented a special instrument, one side of which resembles a Volkmann's spoon, while the other is furnished with a series of sharp steel teeth. The prominent granulations are removed by the spoon, and the others are attacked by *la herse métallique*. One may note, in passing, that Lagrange's instrument has a good deal to recommend it.

Mandelstamm (1883), Hotz (1886), Barton Pitts, Webster, Karwetsky, Wadsinsky, Standish, Noyes, Sattler (1891), Jaesche (1892), advocated "expression" of the morbid material from the conjunctiva by means of the fingers or by the aid of special forceps.

Three further procedures attract attention, more, perhaps, by reason of their complicated character than by their practical utility. I refer to the operations introduced by Noiszewski, Darier, and Lindsay Johnson respectively.

Noiszewski,¹⁷⁹ of Dunaburg, treats intractable cases of trachoma by excising a piece of the diseased conjunctiva from the upper lid, and into the wound thus produced he transplants mucous membrane taken from the patient's lip. The transplanted membrane—which is of rectangular shape, 5 mm. long, 7 or 8 to 11 mm. broad—is retained in place by four sutures. Noiszewski has performed this operation on eight patients, but the results do not appear to have been strikingly successful. Indeed, it is difficult to understand the rationale of any procedure that leaves untouched the superior cul-de-sac, a structure regarded by the best authorities as the principal focus of trachoma. There seems little likelihood, therefore, that Noiszewski's

operation will commend itself to the sober judgment of practical surgeons.

Darier,¹⁸⁰ in 1890, brought under the notice of the Paris Ophthalmological Society a complicated surgical operation, which had suggested itself to him after witnessing the method adopted for trachoma by Herrenheisser, of Prague. His operation—invariably done under general anæsthesia—consisted of the following stages:—(1) enlargement of the palpebral aperture by means of an incision at the external angle of the lids; (2) complete eversion of the palpebræ, so as to expose the whole of the conjunctiva; (3) deep scarifications into the infiltrated tissues, made either with a small double-edged bistoury or by means of a Luer's three-bladed knife; (4) energetic brushing of the scarified surface by means of a stiff-bristled brush soaked in a solution of mercuric chloride (1 in 500). “These different steps constitute,” to quote Darier's words, “a long, tedious, and very bloody operation; but what does that matter if the result be good, and it is.” The after-treatment comprises cold compresses for the first forty-eight hours, while on the third day the lids are everted and washed with sublimate solution. At the end of a fortnight a majority of the patients, so it is said, are cured.

This severe and radical operation is recommended by its inventor in the worst cases of trachoma—that is, those rebellious to the ordinary methods of treatment; it is claimed that, after its performance, pannus and corneal ulcers rapidly heal. In the discussion that followed the reading of Darier's paper, Abadie expressed his opinion that the foregoing operation should be performed in all cases of trachoma that resisted two or three months of the customary escharotic treatment.

Darier's operation has been praised by Fourrey and by a few other surgeons. It is not, however, devoid of risks. For example, it has been followed by symblepharon, by entropion, and by ulceration and even perforation of the cornea.

The third proposal comes from an English surgeon, Mr. G. L. Johnson.¹⁸¹ That gentleman treats trachoma by scarifying the conjunctiva of the lids and fornices with a specially designed scalpel,

armed with three parallel blades, and termed a "silloneur." Along the grooves made by this instrument are passed the terminals of an "electrolyser" in connection with four or six carbon and zinc cells. The operation thus combines scarification with electrolytic action. Johnson reports that he has carried out the method on ninety-eight eyes with good results. It may be remarked, however, that the technique of the operation is complicated; that special instruments are needed; and that the proper management of the electrical apparatus appears to be far from easy. Personally, I incline to the opinion, therefore, that however admirable the plan may be for the treatment of isolated cases, most surgeons will seek simpler methods of attacking the malady.

We have now glanced in succession at the various plans—medical and surgical, rational and fantastic—that have been employed in the fight against trachoma. We have seen the copious venesecti^{ons} of former days yield to the more rational treatment by escharotics, which, in their turn, have been more or less displaced by operative methods. At the present moment we witness the sight of two contending schools, of which one is opposed to almost all surgical interference, while the other urges that operative measures alone should be employed in the treatment of the disease. Fuchs,¹⁸² on the one hand, would operate only in those rare cases where the morbid process is limited to the particular portions of the conjunctiva. Jacobson,¹⁸³ on the other hand, derides all methods of treatment by topical applications, and claims that a radical cure can be attained by surgical means alone.

Such differences of opinion among distinguished observers show that the relative value of surgical and escharotic treatment is still open to question. My own experience leads me to these conclusions. Beyond a doubt most cases of trachoma can be cured by local applications to the conjunctiva, and, on the other hand, comparatively few by surgical means alone. The escharotic treatment, however, which extends to many months, or even years, may be abridged, often with brilliance and certainty, by the timely use of surgical measures. A combined treatment, therefore, is, upon the

whole, not only the speediest, but the safest and the most rational that can be adopted, and it is such a plan that my experience leads me to recommend in a majority of instances.

In the following pages I purpose to discuss the various plans that have rendered me service in dealing with trachoma, and although I may be unable to bring forward much that is new, I can at least join my testimony to that of others in favour or in condemnation of the methods in common use. I would merely add that each plan may claim its successes, and that a multitude of agents, employed in the most diverse ways, are capable of effecting a cure. Time, perseverance, complete control of the patient, and avoidance of routine are the keynotes of success ; and if there be no specific for trachoma, it may be nevertheless asserted that in the long run every case of that disease must yield to the resources of medical art.

For the sake of convenience operative and escharotic methods will be described separately. But it should be clearly understood that in actual practice, as hinted before, the two are often combined, and that they mutually complement and supplement one another.

EXCISION OF THE CUL-DE-SAC.

As already mentioned, the practice of cutting out pieces of diseased conjunctiva has been advocated at various times since the days of Hippocrates. Galezowski,¹⁰⁸ however, was the first to recommend excision of the cul-de-sac as a formal surgical procedure. In a paper published in 1874 he stated that he had performed the operation with excellent results in a series of more than 200 cases. His plan was to evert the eyelid, and dissect away the fornix, previously seized with a pair of double fixation forceps, the so-called *pince à granulation*. As a rule, excision was confined to the upper cul-de-sac, but now and then the lower fold was also removed. It may be added, as a point of practical interest, that in almost all cases Galezowski resumed local treatment three days after the operation.

Despite repeated communications from Galezowski, excision of the

cul-de-sac does not appear to have gained much popularity among ophthalmic surgeons until the year 1882, when Brachet¹⁸⁴ published an account of a patient who eight years before had undergone the operation. The resulting condition was most satisfactory: the conjunctiva was scarred and smooth; the position of the eyelids normal; the movements of the globe not in the least hampered; and, last but not least, the "granulations" were completely cured, and the previously existing pannus cleared up.

Other surgeons hastened to confirm Brachet's experience. Thus, Despagnet¹⁸⁵ examined some of Galezowski's patients twelve or fifteen years after operation, and found that the lids possessed a full range of movement, and were normal in other respects. Santos Fernandez,¹⁷⁰ of Havana, found no untoward results, after a similar interval, in patients on whom he had operated. Voukchévitch,¹⁸⁶ while fully confirming the statements of Galezowski and Brachet, published the clinical histories of a number of cases where excision of the cul-de-sac had been successful in curing trachoma. Schneller¹⁸⁷ was in the habit of removing the diseased folds with a knife, until an accident of a serious nature led him to substitute fenestrated forceps and blunt-pointed scissors for the scalpel. He practised the operation on an extensive scale, and spoke of its value in the highest terms.

One could hardly expect that so radical a method would escape criticism, and as a matter of fact we find that it was met by all kinds of objections. Hotz,¹⁸⁸ for instance, asserted that recurrent inflammations of the conjunctiva and cornea followed as a direct result of the proceeding. He further maintained that removal of the folds must seriously impair the mobility of the eyelids; and said, in so many words, that the cure was worse than the disease. Jaesche¹⁸⁹ expressed a similar view in more temperate language. Lloret¹⁹⁰ condemned the operation, and believed that it was likely to produce entropion. In short, the belief was common that removal of the retro-tarsal folds, by reason of the resulting scar-changes, would give rise to ptosis or other malpositions of the eyelids.

Sattler¹⁴⁵ on the contrary, urged that the objections to the

operation were without foundation in fact, and his opinion was the more valuable, inasmuch as he had abandoned removal of the folds in favour of scraping with a sharp spoon.

While excision of the cul-de-sac has been advocated by many continental surgeons, its claims seem to have been overlooked by the majority of practitioners in this country.

For my own part, I have now performed excision of the upper fornix on upwards of seventy eyes, and many of my patients have been under observation during periods ranging from two to six years. Once only have I seen an untoward result follow the operation. In that case, unequal contraction took place in the scar, and for a time the inner surface of the upper lid showed a groove running down its centre. Seven weeks after the first operation, the cicatrix was dissected up, and a strip of conjunctiva obtained from a rabbit was placed between its cut surfaces. This simple expedient was successful in removing the deformity, which has not returned at the end of five years.

My results show that excision of the upper fornix, if properly carried out, is invariably followed by good results. The fact may be mentioned, however, that in the practice of a friend I once met with a difficulty in evertting the upper lid after excision of the fornix. But in that particular case the operation had not been performed on the lines to be immediately described, and it was obvious that too much conjunctiva had been taken away. As regards my own patients, it is no exaggeration to say that in every instance the removal of the diseased folds had materially hastened the cure of the granular lids.

The condition of things after a successful excision may be thus described. On eversion of the upper lid, a transverse glistening line of scar-tissue marks the site of operation, and the cul-de-sac is represented by a shallow depression. The conjunctiva passes directly from the surface of the lid to that of the eyeball, their junction being formed by the cicatrix just mentioned. The globe is capable of movement in various directions without any obvious dragging upon the eyelid; and there is no ptosis, unless that condition was present before the operation. For that matter, I

have several times seen the ptosis of advanced trachoma actually benefited by excision of the fornix. In these cases, the removal of the swollen and loose conjunctiva seems to enable the levator muscle to act to better advantage, and in that way partly to counteract the drooping of the lid.

My operations upon the lower cul-de-sac have amounted to half-a-dozen only. The reasons that have led me to remove the upper

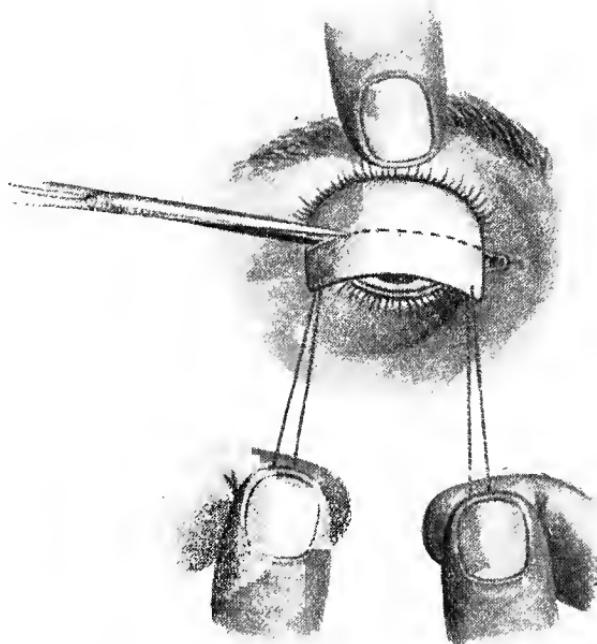


FIG. 1.—Excision of the upper cul-de-sac. The diagram represents the exposed cul-de-sac with its attached threads. The first incision is being made, and its course is indicated by the dotted line.

in preference to the lower fold may be thus epitomised. Owing to the fact that the superior fornix normally contains a relatively large amount of adenoid tissue, it is the rule to find the trachomatous process more advanced there than elsewhere. Further, the inaccessible position of the fold renders it a matter of considerable difficulty to apply local remedies efficiently to its surface. Hence, it often happens that, even after a long course of topical

treatment, the upper fold still contains an abundance of granular conjunctiva, while the other parts of the lids are, for all practical purposes, restored to a healthy condition. This has an important bearing upon relapses, which originate in the majority of cases, from the upper fold. Again, the condition of the cornea is closely dependent on that of the superior retro-tarsal fold. Active pannus, for example, is almost always accompanied by a congested and thickened fornix; I may say, indeed, that, in my experience,

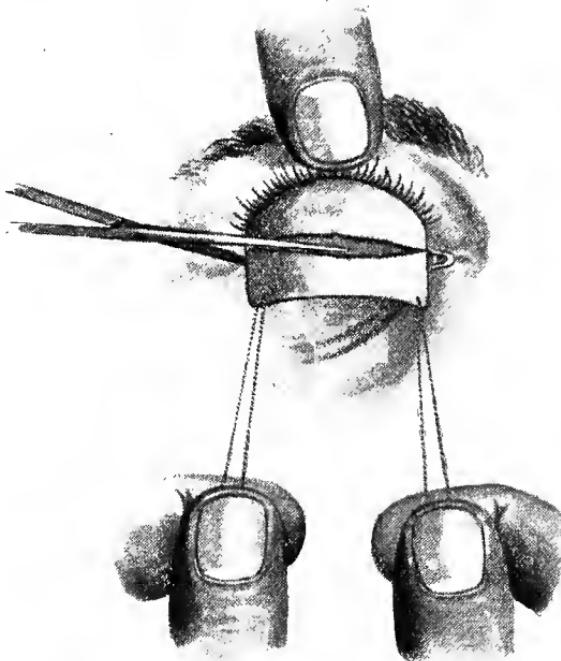


FIG. 2.—Excision of the upper cul-de-sac. The last step in the operation—viz., cutting through the posterior layer of the cul-de-sac.

corneal changes are seldom met with when the condition of the upper cul-de-sac is really satisfactory. Lastly, I may add my conviction that an excision limited to the superior fold is capable of favourably influencing the disease in other parts of the conjunctiva, and that local remedies, useless before operation, often act well after its performance.

At this point the simple method of removing the upper cul-de-sac adopted in all my cases may be briefly described.

The upper lid is everted and the fold brought well into view, which may be readily accomplished in most instances by directing the patient to look down, and at the same time pressing the eyeball upwards. In cases of special difficulty, the fornix may be seized and drawn out by means of toothed forceps. The next step consists in passing through each end of the fold a strong silk suture, the free ends of which are given to an assistant, with instructions to keep the cul-de-sac everted and "on the stretch" during the subsequent proceedings. As shown by Fig. 1, the upper lid is meanwhile kept in position by the operator's thumb. With blunt-pointed scissors an incision is then made along the line of attachment of the fornix to the tarsal conjunctiva, but this incision should include nothing beyond the anterior layer of the fold. As soon as the latter is freed from its attachments, a dissection is made into the sub-conjunctival tissue, and continued as far backwards as the surgeon deems necessary. The dissection will be materially assisted by an intelligent handling of the threads attached to the fornix. During this stage the insertion of the levator muscle will lie well away from the scissors, and is not likely to be damaged if ordinary care be exercised. The operation is completed by cutting transversely through the posterior layer of the cul-de-sac, which thus comes away bodily, together with the attached sutures (Fig. 2).

During removal of the fornix, bleeding is often free, and it may be necessary to twist one or two small vessels. In my own practice, I do not employ sutures to close the wound, although some other operators—Czermak,²⁵⁷ for example—recommend their use.

When the palpebral apertures are narrow, there need be no hesitation in dividing the tissues at the outer angle of the eye before removing the cul-de-sac. Under these circumstances, it is well to secure a permanent widening of the fissure by the insertion of three sutures applied in a manner to be described later (*Canthoplasty*). It should be noted in passing that this plan was recommended by Richet in 1874, and that many surgeons have since adopted the suggestion.

When both eyes are operated upon at one sitting, the lids of

the side first finished should be kept covered during the performance of the second excision. If this precaution be neglected, troublesome bleeding is liable to occur, and clots of large size may collect in the conjunctival sac.

The question of anæsthesia is a matter of practical importance. My own plan is to render the surface of the conjunctiva insensitive by a few drops of a 2 per cent. to 4 per cent. solution of hydrochlorate of cocaine, repeated twice at intervals of three or four minutes. Then an injection of three or four drops of the same liquid is made into the tissues of the cul-de-sac by pushing the needle in deeply, and pressing out the solution drop by drop during its withdrawal. Five minutes later the operation may be performed practically without pain. In a few instances only have I been compelled to administer a general anæsthetic.

Antiseptic precautions must, of course, be adopted, both before and after excision of the cul-de-sac. Thus, before the cocaine is used, the conjunctiva should be cleansed with a tepid sublimate solution (1 to 5,000), and special attention should be devoted to the roots of the eyelashes, which are likely to harbour infective germs. The dressings after operation consist of a piece of old linen shaped to fit the eye ; after being sterilised by boiling it is smeared with iodoform-vaseline (iodoform, 1 ; vaseline, 8), and covered with a disc of alembroth wool. A firmly applied roller bandage will complete the dressing.

In the after-treatment of the operation, the less done in the way of interference the better. Under ordinary circumstances, I do not, for my own part, inspect the wound for four or five days.

Certain immediate sequels may be expected after removal of the cul-de-sac. For example, ecchymosis of the lids, haemorrhages in the conjunctiva, and a greyish film over the operation-site are constantly observed ; while, more rarely, the lids become markedly swollen, or chemosis is seen. In none of my cases was there any rise in body temperature, or complaint of pain. The average length of time between operation and complete healing of the wound was nine to ten days.

Two complications call for particular notice—viz., ptosis and the growth of wound-granulations. With regard to the first, it is necessary to distinguish carefully between temporary and permanent ptosis resulting from excision of the upper cul-de-sac. The temporary and common form is, no doubt, due to general swelling of the parts. It possesses no particular significance, and soon disappears. Permanent ptosis, on the other hand, follows excision of the fornix only when the operator has damaged the tarsal insertion of the levator palpebræ muscle. As already pointed out, the chance of such a mishap will be small if the operation be carried out according to the above directions. In this connection the fact must not be lost sight of that almost every case of advanced trachoma, apart from any question of surgical interference, is accompanied by more or less drooping of the upper lid. Hence, unless careful measurements have been taken, it becomes a difficult thing to say that ptosis in a particular instance has become more marked after operation. From a series of observations, I am convinced that a properly performed excision does not permanently increase existing ptosis, nor does it give rise to that condition. The second complication—the growth of wound granulations—is by no means uncommon after removal of the upper retro-tarsal fold. It was observed in about one-third of my own cases. The growths may attain a large size, and often bear a close resemblance to a cock's comb, both as regards their shape and colour. They are exceedingly vascular, and bleed at the slightest touch. It has been asserted that granulations appear only when antiseptic precautions have failed, but I cannot accept that view. As to treatment, it is useless to apply caustics to the growths. They should be snipped away, as often as may be necessary, with curved scissors.

Attention may now be drawn to some of the special advantages of the method of removing the cul-de-sac that has been described in the foregoing pages. First of all, the operation is as easy of performance as it is rapid in execution. So far from any special instruments being needed, a pair of scissors, a needle, and some silk, complete the surgical outfit. Then, if the fold be removed in

exact accordance with my directions, the levator tendon runs little, if any, risk of damage. In other words, the operation is not likely to be followed by permanent ptosis—a point of obvious practical importance. Lastly, there is the fact that my method permits one to remove just as much or as little conjunctiva as the nature of the case requires.

With regard to the last point, generally speaking, an oblong piece of the fornix, measuring, say, 28 mm. by 9 mm., is taken away, but there are cases in which a smaller or larger excision may be performed with benefit. The trachomatous cul-de-sac, at a certain stage in the disease, is of course larger than it would be in a state of health. It is therefore likely (as insisted on by Walther and other authors) that the piece removed from a diseased fornix is at least twice as large as would be the case under ordinary circumstances.

I have not infrequently observed obstinate lacrymation relieved, if not actually cured, by excision of the superior cul-de-sac. This is, doubtless, related to the fact that the palpebral gland is wholly or partly removed by the operation.*

If we next enquire what class of case is most likely to be benefited by the operation, we shall give the foremost place to those instances where the upper sinus of the conjunctiva is stuffed, as it were, with a large accumulation of granular material. Next in order comes trachoma, in which ordinary treatment by escharotics has proved unavailing. In both conditions, excision will often render yeoman's aid to the surgeon. So far as I know, there is only one state of the lids that contraindicates the operation, namely, when the conjunctiva is extensively scarred, and the fornices almost obliterated by the disease. It is quite conceivable that were excision attempted under these circumstances, the result might be disastrous.

The advocates of the operation claim excellent results. They affirm that the time taken up in the treatment of trachoma is con-

* This body forms, of course, the palpebral portion of the lachrymal gland. It varies in size in different persons, but may be always recognised as a lobulated mass, lying at the outer extremity of the upper fornix. Complete exposure of the latter structure is, however, essential to the demonstration.

siderably shortened ; that corneal complications clear up speedily ; and that a great, if not an absolute, protection is afforded against the occurrence of relapses. They hold, moreover, that the disease in other portions of the conjunctiva quickly recedes after removal of the upper retro-tarsal fold. Their statements tally with my own experience, and I am of opinion that in excision of the fornix we have an operation easy of performance, free from danger, and satisfactory in its results. In order to obtain the best results, it is necessary, however, to pay particular attention to two points—viz., (1) to operate in suitable cases only ; and (2) not to remove too much conjunctiva.

EXPRESSION.

The forcible pressing out from the conjunctiva of the diseased material of trachoma was practised, if we may believe Dr. Swanzy's statement,¹⁹¹ years ago by the late Sir William Wilde. This proceeding was, as we have already seen, recommended by Pilz in 1854, and re-introduced by Mandelstamm,¹⁹² who wrote in 1883. In May of the last-named year, Dr. Keyser,¹⁹³ of Philadelphia, appears also to have adopted a similar treatment.

The operation, however, did not attract general attention until the year 1886, when Hotz¹⁸⁸ published an enthusiastic paper stating that he had followed the method for five years. At one time he had to deal with a very nervous patient who suffered from "follicular trachoma and acute pannus," and who, when his lids were everted for purposes of examination, contracted the orbicular muscle so forcibly that the contents of the trachomatous follicles were extruded "in the form of gelatinous plugs." Next day a remarkable improvement was noted in the condition of the patient, and "in a few weeks he was discharged as cured." Taking his cue from this odd incident, Hotz devised a formal operation for pressing out the follicles. He employed the thumb or forefinger in the upper lids, while he used a pair of modified iris forceps for the lower ones, and he claimed to be able to remove the whole of the trachoma bodies at one sitting.

Hotz's article at once raised "expression" or "squeezing" to the position and dignity of a formal operation. Since the appearance of his paper, many surgeons, especially in America, have worked on a similar principle, and a considerable amount of literature has been published on the subject.

The exact method employed to express the follicles varies, as might be expected, in the practice of different surgeons. Thus, Karwetsky and Westhoff use fingers and forceps, as recommended by Hotz. Pooley¹⁹⁹ prefers to trust to his fingers and thumb nails. Noyes¹⁹⁴ (who has abandoned all other operative measures in favour of squeezing,) uses two pairs of forceps, the ends of which are placed at right angles to the blades, and are grooved. Weeks²²⁰ also uses Noyes's instrument. Prince¹⁹⁵ employs ring-forceps, whose extremities are rounded, so as to avoid laceration of the conjunctiva.

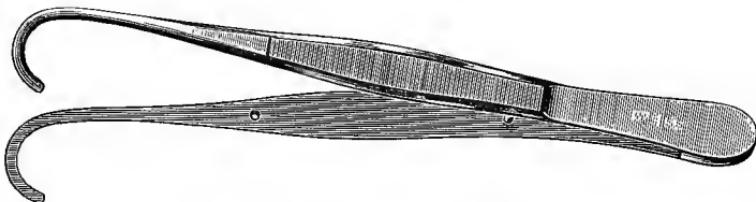


FIG. 3.—Graddy's "Expression" forceps.

Jaesche¹⁸⁹ recommends Himly's fenestrated forceps. Graddy has introduced a special instrument, the blades of which are curved so as to form a semicircle (Fig. 3). Knapp,¹⁹⁶ however, has devised one of the most noteworthy improvements in the shape of a pair of roller-forceps, which he thus describes:—"The instrument is made according to the principle of the mangle. The branches of ordinary rather strong forceps divide at their ends like a horse-shoe, the free space of which is closed by a creased steel cylinder which rolls on pivots in sockets. The ends of the forceps thus resemble a stirrup. . . . The rolling cylinder (the foot-plate of the stirrup) is 20 mm. to 25 mm. long, and 1 mm. to 1.5 mm. thick. It is made of steel, and can be taken apart to be cleaned."

In my own operations I employ two kinds of forceps: 1st, stout-toothed dissecting forceps, provided with broad extremities; 2nd,

stirrup-forceps modified from Knapp's original pattern.* The rollers in my instrument are 9 mm. to 10 mm. in length, and their surfaces are not creased. Again, experience has convinced me that the comparatively small diameter (1 to 1.5 mm.) recommended by Knapp is insufficient to allow the rolling action of the instrument to come into play, at any rate when dealing with swollen tissues. In my own instrument, therefore, the diameter of each cylinder is 3 mm.

Expression, which I have performed on upwards of 650 eyes, is indicated in the following conditions:—(a) In trachoma of recent origin, expression often yields excellent results. The most promising cases are those in which the culs-de-sac, whether upper or lower, are

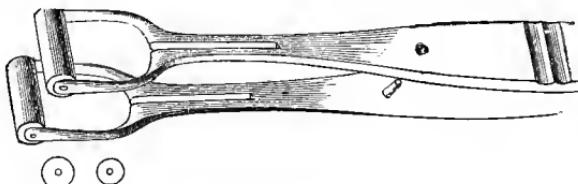


FIG. 4.—Stirrup or roller forceps for “Expression” (Author's model).

occupied by large masses of granulations, which spring into prominence as soon as the lids are everted. The more exuberant the tissue, the more satisfactory will the results of the operation prove. Neither the presence of pannus nor of corneal ulcerations can be considered as forming any contraindication to expression, which, however, is not so well suited for trachoma in which the papillary preponderates over the sago-grain change. (b) In old and obstinate

* My modified roller forceps were constructed in 1892, and exhibited at the meeting of the British Medical Association in July of that year. It is, however, only fair to Dr. Knapp that an extract from a communication by him, which appeared in the early part of 1893, should be given in this place. “By a singular mistake, for which I cannot account,” he writes, “the length of the rolling cylinder has been misstated in my publication as being 20 to 25 mm. It never was more than 9 or 10. This error, which has also crept into the German translation of my paper, came to my notice only a few days ago, when I read the article of Sydney Stephenson on ‘The Surgical Treatment of Trachoma,’ in the January number of the *Ophthalmic Review*, where he says that he has modified the roller forceps in making the cylinder only 9-10 mm. long, but 3 mm. thick instead of 1 to 1.5 mm. In the instruments that I have used during the last year the cylinder is 2 to 2.50 mm. thick” (*Arch. f. Ophth.*, Leipzig, No. I., bd. xxii., p. 112).

cases of disease expression not infrequently affords results of an unexpected nature. If the conjunctiva be scarred in its whole extent, if the culs-de-sac be obliterated by the malady, in short, if there be no local or general collection of succulent material, then the operation will be useless. But usually the cicatricial processes are not complete, and masses of granular tissue are present, either in the retro-tarsal folds or about the caruncle. Under such circumstances, the operation may be resorted to without hesitation, for although it may not wholly cure, it will rarely fail to expedite matters.

The pain caused by the squeezing leads many surgeons to adopt a general anæsthetic. Personally, however, I seldom employ anything but cocaine, applied in the first instance to the conjunctiva, and then injected deeply into the tissues of the upper fornix by means of a hypodermic needle. I have sometimes used nitrous oxide, administered in a way first brought to my notice by my colleague, Mr. Sidney Spokes. The inhalation is commenced just as in the ordinary method with gas, and continued until the patient becomes unconscious. The operation is then begun, and one or two breaths of air are admitted, the pure gas being next resumed. This sequence of events is kept up as long as necessary, and a complete operation on all four lids may be carried out without the patient recovering consciousness. The rotatory movements of the eyeball, so often observed during nitrous oxide anæsthesia, offer no serious obstacle to the surgeon.

Before operation, the conjunctiva should be cleansed with tepid sublimate solution (1 to 5,000), and especial care must be taken to remove all traces of discharge from the eye. The patient should lie on a couch of moderate height. Then as a first step, it is necessary to squeeze out the contents of any grains that project markedly above the level of the membrane, and next, to subject the retro-tarsal folds and the entire extent of the conjunctiva to the squeezing process. Since it is known that the tarsus itself participates in the morbid processes of trachoma, it is important to pay particular attention to that structure, which must be thoroughly squeezed during the course of the operation. Further, the caruncle and the

extremities of the superior fornix—which act, so to speak, as fastnesses for the infective material—must be carefully attended to.

The instrument I prefer for general use is the roller forceps, and a word in regard to the method of its employment may not be out of place. The first plan, which applies to either lid, is to place one roller on the cutaneous, and the other on the conjunctival surface. The blades are then closed, and the forceps firmly drawn towards the free margin of the lid, by which means the roller action is brought into play, and the morbid material squeezed out from the conjunctiva. During this manœuvre, the tarsus (of upper or of lower lid, as the case may be) is necessarily subjected to considerable pressure. In the second method, which applies to the upper lid only, the latter is everted, one roller pushed deeply into the cul-de-sac, while the other is placed over the tarsal conjunctiva as near the free border of the lid as possible. The blades are then closed, and the instrument drawn towards the free edge of the folded conjunctiva, so that each roller lies in contact with mucous membrane throughout the whole of the manipulations. The third method, also, applies exclusively to the upper lid. One roller is placed in the fornix, and the other on the surface of the tarsal conjunctiva. The blades of the instrument are next closed, and the rollers drawn horizontally along the membrane, commencing at the centre of the lid, and ending at its inner or outer extremity, as the case may be. A fourth method submits a swollen and granular fornix bodily to the action of the forceps. In cases of special difficulty it is not a bad plan to pick up the fornix by means of toothed forceps, and then to grasp it with the rollers.

In all these manipulations the conjunctiva passes through the forceps much in the same way as linen is passed through a mangle, with the result that the diseased material is extruded without serious damage to the actual tissue of the conjunctiva. At the same time, it is by no means uncommon for shreds of that membrane to be detached, but that is not a matter of great importance since they can be readily replaced on completion of the operation. One practical point should be mentioned, namely, that it is well to make traction

on the forceps in as straight a line as possible, so as to preserve an equable pressure on all points of the rollers.

The lower lid is more difficult to attack than the upper. Perhaps the best and simplest plan of dealing with it is to pick up each fold of membrane with dissecting forceps, and thereby to get it within the grasp of the rollers. A favourite method in my own work consists in the employment of two pairs of dissecting forceps, one of which is used for seizing and the other for crushing purposes.

It is noteworthy that the conjunctiva is extremely tolerant of the apparently rough treatment involved in the operation of expression. The softer material of the granulations, as well as the lymphoid infiltration, breaks down long before the pressure used is sufficient to damage the conjunctiva itself. The surgeon can judge when enough has been done, not only by the appearance of the parts, but also by the feeling of the tissue beneath the forceps.

A claim has been put forward that the operation of expression is not followed by cicatricial changes in the conjunctiva, a view not supported by the results of my experience. On the contrary, scarring, if it has not already commenced, generally soon makes its appearance after the operation.

During the operation, considerable bleeding often occurs, and it is not unusual for the cul-de-sac to start forward as a violet-purple fold, in consequence of the rupture of a deeply-seated vessel. This complication, however, need not stop the surgeon from completing his work.

The expressed material is often thrown forcibly to a considerable distance, and may fall into the eyes of operator or assistants, an accident not unlikely to be followed by serious consequences. In order to meet this contingency, it might be well for the operator to wear a pair of protective goggles, a practice generally adopted by the present writer.

The after-treatment of expression is simplicity itself: bleeding is encouraged by the assiduous application of hot boric or sublimate lotion to the closed lids, and in about half-an-hour's time the clotted blood, usually present in the sinuses of the conjunctiva, may be

sponged away. No dressing is needed, and the eyes are not bandaged.

Ecchymosis of globe or of palpebræ, redness of the conjunctiva, and some swelling of the lids, may each and all follow the operation, although, as a general rule, there is remarkably little reaction. It is, however, by no means rare for a greyish membrane to make its appearance on the palpebral conjunctiva a day or two after operation, and now and then I have seen a film of the kind over the conjunctiva of the globe. Such membranes, which are easily detachable from the underlying tissue, commonly follow any operative interference with the conjunctiva, whether in the shape of crushing, scraping, or burning. They are of little importance, and seldom last long.

One further point should be noted,—adhesions, which are liable to form between adjacent folds of conjunctiva, more especially in the lower lid, should be searched for systematically, and broken down with a probe. The mere forcible eversion of the lid will sometimes suffice to rupture them, a small operation the performance of which may be left to a skilled and careful nurse. It is rare to find permanent adhesions after the operation, when proper precautions have been adopted.

It is perhaps worth while to add that a single application of contractile collodion to a much swollen lid, will often bring about a rapid improvement.

Once only have I witnessed any unpleasant sequel to expression, and that case was of so unusual a nature as to merit a somewhat detailed description. K. M. L.—a well-grown girl, eleven years of age, with delicate skin and light hair—was received at the Ophthalmic School on 25th June, 1894, suffering from trachoma, complicated with pannus and ulceration of the corneæ. Four days after admission, expression was performed upon each eye. Haemorrhage was free during the operation, and for a few hours considerable bleeding took place from the eyes, the nose, and the mouth. During the next month (July) the bleeding continued, occurring, on the average, every second day. The nurse usually noticed at the inner canthus a large blood-stained tear, which trickled down the patient's

cheek, and dried upon her face and pinafore. Traces of a similar fluid, also, were seen on more than one occasion about her nostril. Although the child was frequently brought to me as soon as haemorrhage was observed, yet I was never able to identify the point from which it came ; the palpebral conjunctiva was uniformly red and turgid. At first I laboured under the impression that I had to deal with a case of simulation. The patient, therefore, was carefully watched, but haemorrhage recurred again and again under conditions that, to my mind, placed malingering out of the question. During the month of September, bleeding occurred upon twenty-one days, and the fluid that escaped from the eyes had all the characters of blood. Thus, when examined under the microscope, it was found to contain numerous crenated corpuscles ; when mixed with ozonic ether and tincture of guaiacum, it gave a sapphire-blue colour ; and after treatment with sodium chloride and acetic acid, haemin crystals could be extracted from it. During October, haemorrhage took place on seven days ; during November, on five days ; during December, on four days. After lasting for upwards of five months, it finally ceased upon 6th January, 1895. Upon two days, the flow recurred as many as eight times, but usually came on once or twice only in the twenty-four hours. It seemed to bear no relation either to posture or to occupation, and affected now the right eye, now the left eye, and now both eyes. It would come on at all hours, and more than once the loss was estimated at half-an-ounce. The girl had not commenced to menstruate. There were no signs of anaemia, scurvy, or purpura. Hæmophilia seemed to be excluded both by the sex and age of the patient, and also by the fact that neither a cut in the temple nor the extraction of a premolar tooth was followed by excessive bleeding. It should, however, be noted that there was a history of swollen knee-joints, occurring thrice, and lasting for a few days upon each occasion. A brief account of this remarkable case will be found in the *Brit. Med. Journ.*, London, 1895, vol. i.

To complete the cure of trachoma, expression may have to be repeated at intervals of weeks or months. The first operation is,

generally speaking, the most severe. Each one afterwards is of slighter moment, since it deals merely with localised deposits that have either escaped notice in the first instance, or have appeared subsequently. For these secondary operations, as a rule, dissecting forceps will be found more serviceable than the rollers.

Comparatively few cases of trachoma can be cured by squeezing alone ; in nearly every instance local treatment must be adopted as well. The latter may be commenced a few days after operation, that is, before all traces of surgical interference have disappeared. My routine practice is to apply a 2 per cent. solution of silver nitrate to the palpebral conjunctiva on the third day after squeezing, and to continue the topical treatment until the parts have thoroughly healed. Then the silver may be replaced by stronger agents, such as bluestone or corrosive sublimate. Under such circumstances, it is surprising to note the good results from escharotics, which simply made matters worse when used prior to expression.

ESCHAROTIC TREATMENT.

It may be laid down as an axiom that the systematic application of escharotics will cure the majority of cases of trachoma. In the following pages it is my intention to speak only of remedies of which I have had practical experience ; to indicate the precise methods of using them, and the results that may be reasonably expected from their employment.

Whatever be the particular agent selected, its skilful application is a matter of first importance. It will save repetition if the method of applying solids and liquids to the conjunctiva of the lids be described once and for all.

The points to be aimed at are three in number, viz :—(1) thorough exposure of the conjunctiva ; (2) removal of any moisture or discharge that may be present ; and (3) efficient application of the remedy selected.

My own practice is to station myself behind the patient, who is seated in an ordinary chair, with a towel thrown over his head. The upper lid is then everted—a manœuvre of which the details can

be obtained from any text-book of ophthalmology. An assistant who stands in front next draws the lower lid downwards, and the patient is directed to close the eyes gently. Any discharge that may be noticed should be removed by means of a morsel of absorbent wool, or by a piece of "paper-fibre lint," a material composed of the pure fibre freed from chemicals. If neither of these be at hand, a small square of white blotting paper may be used as a substitute.

When the conjunctiva has been cleansed, solid applications may be then passed over its exposed surface in such a way that every part of the membrane receives attention. It is of great importance that the upper cul-de-sac be not permitted to escape the action of the caustic, but no little dexterity and practice will be required to reach the recesses of that cavity. Perhaps the best plan is to tilt the everted lid forward, which can be readily done by manipulation with the finger; at the same moment the caustic point is passed beneath the lid and up into the fornix. Among other sites that demand special attention are the inner and outer extremities of each lower lid. It is an excellent routine practice to use the right and the left hand alternately when applying the escharotic, as in that way a slightly different part of the conjunctiva is reached on each occasion. The advice is sometimes given to touch the characteristic granulations only, but the counsel is superfluous: there are few cases of trachoma where the conjunctiva is not infiltrated with lymphoid material, a pathological change just as much a part of the disease as the granulations themselves.

When dealing with young or troublesome subjects, a different plan must be adopted. The surgeon having thrown a macintosh sheet over his knees seats himself in an ordinary chair. Facing him sits a nurse, who lays the child across her lap, so that the arms are held between her chest and left upper extremity, while the wrists are seized by her left hand. The patient is thus rendered helpless, and his head is grasped between the surgeon's knees. It will be noticed that whereas the nurse has her right hand at liberty to help the surgeon, the latter has both hands free. The next step is to evert the lids fully, and apply the remedies in the manner already described.

Before using a solid medicament, care should be taken that its surface is smooth, as otherwise not only will escharotic action be unequal, but unnecessary pain will also be caused. Some agents, as lunar caustic and corrosive sublimate, possess a surface naturally free from roughness, and will, therefore, need little preparation. Others, however, call for certain precautions in order to render them fit for application to the conjunctiva. Greenstone, for instance, should be gently melted in a spirit-flame, and the excess of melted stick wiped off until it is of proper shape. With bluestone, again, any asperities must be removed by friction with glass- or emery-paper, or by rubbing with a damp cloth. It is a common mistake to give these substances too sharp a point, whereby they are likely to prick the mucous membrane, and so to cause discomfort and local ecchymosis. Moreover, a sharply pointed stick is less easy to work with than a blunt one. The copper point, therefore, should be ground to a transverse diameter of not less than three millimetres, that is, roughly speaking, about equal in size and shape to the conical end of an ordinary wooden penholder.

Liquids are usually applied by means of a camel hair brush, the "duck" and "goose" sizes being most suitable for the purpose. The preliminaries are identical with those described in the case of solid agents. The brush, previously dipped in the fluid, is lightly passed over the diseased parts of the conjunctiva, and the remedy allowed to remain in contact with the membrane for a time that will vary according to circumstances. It is often advisable to pass the brush under the upper lid, and into the superior fornix, an operation that needs some care.

It is by no means an easy matter to lay down any general rule as to the length of time during which a liquid should remain in contact with the conjunctiva. The surgeon must be guided almost as much by the stage and nature of the malady as by the strength of the agent employed. An application of silver nitrate, for instance, that would cause a slough in the acuter forms of trachoma would merely act as a mild remedy in chronic forms of that disease. Again, tolerance towards a given escharotic is speedily established, in which

case it may be pushed with safety. Broadly speaking, however, liquid medicaments may be allowed to act upon the membrane for five to ten seconds before the lids are replaced.

It has been suggested that a brush, if used for more than one patient, may be the means of conveying infectious particles from eye to eye. Without wishing to deny that such might possibly be the case, it may be pointed out that the antiseptic action of the strong re-agents employed in trachoma would probably destroy any disease-germs. To avoid any risk of the kind, however, the same brush should not be used for more than one person ; it should, moreover, be carefully cleansed, both before and after use. At the Ophthalmic School each patient possesses his own brush and beaker, which are retained for his exclusive use. The brush, it may be added, is marked in legible characters with the name of its owner. With a little care there is no great difficulty in limiting the use of those articles to a



FIG. 5.—Cotton wool holder for applying liquids to the palpebral conjunctiva.

single patient, even when a large number of children have to be looked after.

In specially infective cases a brush may be used once only and then destroyed, although that is obviously a somewhat extravagant proceeding. It is better, therefore, to take a splinter of wood, like those used in foreign restaurants as toothpicks, and to arm its end with a covering of absorbent wool. After use, the extempore brush is at once burned. On an emergency the splinter may be replaced by an ordinary wooden match. A simple instrument for the purpose has been devised by the present writer. It consists of a German silver rod, some six inches in length, of which the lower part is oblong and grooved. The latter is plunged into cotton wool, of which, by a few quick turns, sufficient is taken up to form a passable brush. After use, the wool wrapping is removed, and the instrument is placed for twenty minutes or so in 1 to 30 carbolic lotion, or

it may be boiled or passed through a flame, so as to ensure sterilisation.

The application of escharotic agents, whether solid or liquid, produces remarkably little reaction. It usually causes a certain amount of pain, lasting perhaps ten minutes, together with some watering of the eyes and intolerance to light. As a rule, it is also followed by swelling of the palpebral conjunctiva, a fact that may be readily demonstrated by everting the lower lid, when the membrane is seen as a roll of purple hue.

A curious condition, occasionally observed in neurotic patients, is clonic spasm of the orbicularis muscle, which sets in whenever an attempt is made to treat the eyes. The phenomenon is of scientific rather than of practical importance. It is clearly of nervous origin, and to that extent comparable with the sweating which sometimes follows the application of caustic agents to the conjunctiva.

Another appearance sometimes noted is a transient puffing of one or both lower lids.

On rare occasions I have seen spasmodic entropion follow the application of remedies, but that condition, which occurs exclusively in the lower lids, has no serious significance; it subsides, either with the pain or after the displacement has been reduced by manipulation.

A striking appearance is sometimes seen when an escharotic, such as bluestone, is applied to a conjunctiva which is shielded, as it were, by a thin layer of discharge. The membrane becomes covered almost at once by a sheet of coagulated secretion, so that the parts look as though they had been cauterised.

The possibility that the use of strong agents might be followed in timid children by nervous symptoms was suggested to me some years ago by Dr. Bridges, then Local Government Board Inspector. I may say that after the experience afforded by many thousand applications to the conjunctiva I have never seen anything of the kind occur, even among debilitated children. Nor have I heard of any such effects from other practitioners experienced in the treatment of trachoma.

Indeed, the only common mishap is the production of a conjunctival slough. This state of things is not infrequently seen when a strong remedy is applied for the first time, although it is distinctly rare when tolerance has been once established. The slough, which is quite superficial, generally affects the lower lid, and is not infrequently associated with redness of the neighbouring bulbar conjunctiva. It speedily disappears, and demands no special attention beyond ordinary cleanliness. For the time being, the escharotic should, of course, be stopped, and resumed only when the last trace of slough has vanished, and the lids resumed their usual condition.

It is quite likely that the cornea might be injured by the careless use of a caustic point. But, apart from culpable negligence of that sort, the accident may occur when dealing with an unruly subject. It has, in point of fact, taken place under the latter circumstances four times in my own experience, although in no single instance was the damage of a serious nature. In each case, a small grey patch of infiltration, like that following a superficial burn, appeared in the lower third of the cornea, and healed under simple remedies in the course of a few days. Fortunately, the resulting nebula, being out of the line of sight, caused no defect in vision.

The best way of assuaging pain after the application of escharotics is by the instillation of a 2 per cent. solution of the hydrochlorate of cocaine, not only before but also after treatment.* There are some patients, however, who steadfastly decline to make use of that drug, which, according to them, serves merely to aggravate their unpleasant sensations. In such cases, fomentations of cold water, applied for ten or fifteen minutes to the closed eyelids, often succeed in allaying discomfort. Another efficacious plan is to spray the lids with the water. Hot water has been recommended, but

* Chemically, at any rate, the hydrochlorate of cocaine and nitrate of silver are incompatible. Hence, when using the latter agent, pain should be allayed by the nitrate of cocaine, between which and the caustic no incompatibility exists. The nitrate salt is readily soluble in water, and may be employed as a 2 per cent. solution.

in my experience, it does not act so well. Crying or rubbing of the eyes should be discouraged ; and it is well to bear in mind that a brisk walk in the open air, or an energetic game—as football—will often make young patients speedily forget their troubles.

It is a curious fact that the severity and duration of pain seem to bear but little relation to the particular agent employed. One patient will aver, for instance, that the silver preparations cause more uneasiness than those of copper, while others will assert exactly the contrary. Again, no matter what be the remedy employed, one individual will suffer much and another little. In fact, the sensation, so far as I can judge, is more closely connected with the constitution of the patient than with anything else. At least, I see no other way of accounting for the contradictory statements that are constantly made to me on the point.

The effects produced by any solid agent will depend, first, upon the time it remains in contact with the conjunctiva ; and, secondly, on the pressure used in making the application. This is equal to saying that a variety of results may be obtained from one and the same escharotic.

My general rule is to apply strong remedies once in the twenty-four hours. In exceptional instances they are used twice during that period—a method which is certainly of great value, although it is difficult to lay down exact rules as to the particular cases in which it should be adopted. Still, in general terms, it may be stated that the more chronic the trachoma, the more satisfactory will the frequent applications prove ; and that a trial should be made of them whenever the daily use of an escharotic does not expedite cure.

The best time for making the applications is early in the morning. To my mind, it is a mistake to treat cases of trachoma late in the day, because the medicament gives rise to increased secretion, which collects in the eye during sleep, and thus aggravates all the symptoms. If the patients are attending school while under treatment, strong remedies, however, ought to be used at the termination of the school-day, so as not to interfere with tuition. This practice is found to work well at the Ophthalmic School. It

possesses some distinct advantages. For example, the patients are not in a position to ascribe to treatment that which is due in reality to laziness or to stupidity. Furthermore, a sufficient time elapses to get rid of all discharge, and thereby to avoid the discomforts and dangers that are inseparable from remedies applied the last thing at night.

A word may be added as to the relative advantages of solid and liquid applications. The former are the more difficult to apply efficiently; their use must be therefore confined to the hands of the surgeon himself. The only exception to this general rule is in the case of a skilled and careful nurse, who has been taught how to use the remedy. In fractious children, solid medicaments may be quite out of the question, at any rate until the patient has been schooled to obedience. Liquids, on the other hand, require much less skilful handling: it would need a clumsy individual, indeed, to do much harm with a camel-hair brush. Finally, it is easier to limit the action of a solid than of a liquid to any particular portion of the conjunctiva.

The alternate application of two escharotic agents—for example, bluestone and acetate of lead—has been lauded by some writers. I have made numerous trials of the method, but cannot say I have been much struck by its advantages. After all, a single escharotic either does, or does not, suit a given case. If the former, its application should be persevered in until cure has been attained; if the latter, the sooner the agent is changed for another the better for the patient.

A good deal of misconception exists with regard to the period over which escharotic remedies must be continued. Some of the text-books still contain the statement that mild cases of trachoma may be cured in a few weeks. Such is far from being my experience. Roughly speaking, it may be said that few cases recover in less than eighteen months, while many need treatment of a much longer duration. I know of a few patients, indeed, who have been treated day by day for upwards of six years, but they are still uncured. The progress made is often so slow as to be almost

inappreciable unless the intervals between successive examinations be of some length.

The course of trachoma, when treated by escharotics, is usually somewhat as follows.—Subjective symptoms, as pain and photophobia, soon disappear, and secretion is reduced to a minimum. Ulcers of the cornea heal with or without the production of a so-called facette. The coarser granulations get smaller and smaller, and are ultimately lost to view, being merged in a more or less general thickening of the palpebral conjunctiva. Papillary overgrowths, however, are more resistant to treatment, and a considerable time will elapse before any marked reduction takes place in their size. The enlarged vessels of pannus gradually dwindle to such an extent that they can be recognised by careful examination only. At the same time, the accompanying opacity of the cornea becomes less and less ; but if of long standing and deeply situated, no amount of local treatment will cause its complete resolution. After a period that varies considerably, but which generally averages from six to nine months, the only morbid changes to be seen in the conjunctiva are general congestion and thickening, with some reduction in the depth of the upper cul-de-sac, and faint scarring of its surface. Another appearance often noted is a band running across each lower lid. It is thickened and red, and when closely examined, is seen to contain small white dots, the remnants of sago-grains. Further improvement will follow, until in, say, twelve or eighteen months after the commencement of treatment, the conjunctiva, now considerably thinner, will be traversed by a net-work of scar-tissue, chiefly, though not exclusively, confined to the superior fornix and upper lid. At the same time, the eyes will be practically free from discharge and other symptoms.

It is often a matter of considerable difficulty to determine when cure has been effected in any given case. In considering this question, it must be borne in mind that the cure of trachoma is relative rather than absolute. Affections like scarlatina and most other zymotic fevers pass through their various stages and reach a definite end. It is quite otherwise, however, with trachoma. In that malady

the granulations disappear, and the mucous membrane becomes smooth, scarred, and pale to an extent that will vary in different instances. Secretion, again, may be got rid of totally ; or it may, on the other hand, continue to be thrown off in minute quantity for an indefinite period. In short, there is absolutely no uniform appearance of the conjunctiva from which one can tell whether the affection be cured or not ; each case must be judged on its own merits, and on those alone.

Experiment is generally necessary to decide the point. My own practice is to omit all radical treatment as soon as the conjunctiva becomes smooth, notwithstanding the fact that it may remain thick and red. In the first instance, escharotics are stopped for a week, and if all be well at the end of that time, for a further seven days. If there be no recurrence at the termination of the fortnight, a month is added to the period of probation. During this time, it is not uncommon for the conjunctiva to lose its redness, to become thinner, and for the small amount of discharge present under caustic treatment to subside. The patient (whose sensations are sometimes not without their value) will often volunteer the statement that his eyes feel better and stronger day by day. In a proportion of cases, however, the results of the discontinuance of escharotic treatment are not so satisfactory. The conjunctiva gets redder, and the caruncle swollen ; granular material makes its appearance ; the eyes become bloodshot, and are described as "weak," and the lids are glued together by discharge. When the lids are everted, small haemorrhagic points may be observed upon the palpebral conjunctiva, and these "irritation spots," as they may be called, are unfailing signs that trachoma is in an active condition. Another valuable test is to notice whether the palpebral conjunctiva is coated by shreds of mucus, which, when present, show that the disease is not quiescent. Under such circumstances, no time should be lost in getting the patient under treatment ; and it will generally be found that the agent which suited the case formerly will do so again.

If, after six or eight week's observation, however, the conjunctiva remains in good condition—that is, without marked redness or renewed growth of granular material—the case may be looked upon

as cured. But the patient should not only be seen from time to time, but should be urged also to report at once any symptoms, as uneasiness, discharge, or redness of the eye. The importance of these precautions lies in the fact that a recurrence of disease may be often nipped in the bud, as it were, by prompt attention. Thus, I have often seen lids that showed signs of fresh irritation yield completely to treatment in a fortnight.

Although, as already stated, there is no uniform standard by which the cure of trachoma may be recognised, yet certain appearances are usually associated with cessation of the morbid process. These vary according to the severity of the original malady. In the slighter cases, for instance, the conjunctiva will be so smooth, pale, and thin as to appear almost normal. A careful examination, however, will disclose signs of scarring, either as a fine white line occupying the subtarsal sinus* of the upper lid, or else as a delicate network in the superior fornix. The cornea, as a general rule, shows no morbid change. In cases of a more severe type cicatricial bands can be scarcely overlooked. They affect not only the above mentioned sites, but a great part of the upper lid as well. Their meshes, often enough, enclose islands or tufts of papillary overgrowth. The general colour of the conjunctiva will depend to a large extent upon the amount and distribution of these scar changes. If the latter be insignificant, red will preponderate, but otherwise the colour will be more or less white. The upper and the lower cul-de-sac are shallower than normal, and in some instances may be completely obliterated, a condition to which Von Ammon gave the name of *symblepharon posterius*. The cornea, especially in its upper half, is often more or less cloudy, although no vessels are to be seen, either with the naked eye or by the use of the magnifying glass. The deformed upper lids droop, so that the patient has the sleepy appearance characteristic of the malady. Other sequelæ need not detain us in this place.

* The subtarsal sinus is a shallow groove seen when the upper lid is everted. It lies about 2 mm. above the inner edge of the intermarginal space—that is, the free border of the lid. It marks the place at which vessels from the lower palpebral arch pierce the tarsus to supply the conjunctiva.

Curious though the statement may seem, it is easier to cure an advanced than an early case of trachoma. The natural history of the malady furnishes us with the key to this anomaly. The disease has a tendency to terminate in spontaneous cure, although the process may occupy many years in its completion. It comes about by the production of scar-tissue, the advent of which may be hastened by escharotic, as by other means. Hence the appearance of cicatricial bands must be regarded as a favourable sign, indicating that the trachoma has reached its turning point. Advanced cases are, therefore, as it were, on the high road to recovery, and medicinal or operative measures merely serve to quicken the work that nature has begun. On the other hand, the earlier the stage, the longer must the period of onset of scarring be deferred, and the more prolonged must be the treatment.

It is common for fluctuations to occur during treatment, so that the escharotic, which, as a rule, agrees admirably, becomes for the time an absolute failure. These "refractory periods," as they may be termed, last from a few days to as many weeks, and although they sometimes accompany an affection of the general health, as diarrhoea, yet their cause or causes for the most part remain quite obscure. The practical point is to continue treatment until the period be tided over, when the remedy will resume its beneficial action.

A description of escharotics that did not attempt to give some explanation of their *modus operandi* would be incomplete. Besides being caustic and astringent, those commonly employed have, for the most part, potent antiseptic properties. Their efficacy in trachoma probably depends on three factors. In the first place, they destroy the surface microbes by direct action, and after absorption, no doubt act upon the micro-organisms in the deeper tissues. Another point is that they excite an abundant flow of serum, which, in all likelihood, has a double action:—(a) mechanical, by washing away micro-organisms; and (b) chemical, by virtue of the antiseptic properties possessed by blood serum. Lastly, phagocytosis may be concerned in the matter; it is conceivable that the destruction of the active germs of disease may be carried out by leucocytes, which

have left the vessels in response to the irritation set up by the escharotic.

It has been suggested that some of the good effects produced by solid applications are due to causes of a purely mechanical nature, such as pressure and friction. In order to settle this point, I experimented some time ago with various indifferent substances (sealing wax and wood) shaped like the copper sticks. The lids were rubbed day after day, but without definite improvement in a single case. Apart from experiment, indeed, a little consideration will show that this theory of action cannot be based on firm ground; for if that were the case, it would be difficult to explain the good results produced by liquid re-agents.

The phrase *agent modificateur*, long ago coined by Hairion when describing the action of lunar caustic, expresses exactly that which one is desirous of accomplishing by the long continued use of escharotics. By their methodical employment we hope to effect so profound a change in the condition of the conjunctiva as to bring about a more healthy state of affairs. It is in exceptional circumstances only that a caustic action—that is to say, an actual destruction of tissue—is called for. As a matter of fact, one attempts to avoid anything of the kind, even on a limited scale, and many a case of trachoma is cured without the production of a single slough.

In order to simplify the description of remedies, trachoma may be regarded as consisting of the following stages:—(1) deposition and development of granulations; (2) hypertrophy; and (3) cicatrisation and atrophy of the conjunctiva. It should be clearly understood, however, that the classification is artificial, inasmuch as one stage often co-exists with another. At the same time, it may be defended from a clinical point of view, and there will generally be no great practical difficulty in deciding under which category a given case will fall.

To some extent, the ground has now been cleared. The principles laid down in the foregoing pages apply to the various agents of which I have had personal experience, and which I shall now proceed to enumerate.

The most generally useful medicament, as well as one of the most ancient, is bluestone, or, as it is termed nowadays, sulphate of copper. It may be employed in almost all stages of trachoma, but in chronic phases of the disease it has almost a specific action. Bluestone is, without doubt, the best agent that can be used when the conjunctiva is markedly thickened, and its secretion scanty. Its application is not contraindicated by pannus, but it should not be employed when active ulcers of the cornea are present, or when there is much discharge. It is by far the best remedy for routine treatment with which I am acquainted, and one may say, broadly, that the more chronic the case, the more good is it likely to effect.

The excellent results obtained by the use of bluestone are probably owing to two facts. The first is, that its penetrative powers exceed those of any other agent; secondly, that while bluestone is sufficiently potent to cure trachoma, its action is mild enough to permit of its being applied to the upper cul-de-sac with the utmost freedom.

Bluestone neither stains, nor is it likely to injure the cornea, and it may be applied for years without danger.

Sulphate of copper may be used in two forms—viz., in mass, or in powder.

With regard to its application in mass, the older method was to employ a smooth crystal, with which the conjunctiva was freely rubbed. Nowadays the crystal is replaced by a conical point, of which perhaps the best form is that known by the trade name of Johnson & Son's, No. 4 size, shaped to fit the caustic-holder found in every surgeon's pocket-case. A still better plan, and one that I have adopted exclusively for the last few years, is to have the bluestone ground into a crayon, and cemented into a stout wooden handle, fitted with a cap. This simple contrivance is most convenient in actual practice, and possesses at least two distinct advantages over the ordinary forms, namely—(1) the copper stick is of considerable size, and hence does not readily wear away, a consideration of some importance when many patients have to be dealt with; and (2) a

smooth surface can be quickly obtained, which is not the case with smaller points.

The method of applying the solid crayon to the conjunctiva has been already described (p. 165).

In the second form, sulphate of copper is employed as a fine powder, but care is needed in order to pulverise the crystals satisfactorily.* A state of minute subdivision, however, must be insisted upon, since coarse particles give rise to a good deal of irritation and pain. To apply the salt, the lids are everted, and the powder flicked over the surface of the conjunctiva by means of a small camel-hair brush. In the first instance it is not advisable to apply much of the medicament ; but later, when the eye becomes tolerant, the salt may be more freely used. Indeed, it is not a bad plan, under the latter circumstances, to dispense with the brush, and to bring the powder into intimate contact with every accessible part of the membrane by the pulp of the forefinger. The application of the pulverised salt certainly exercises a very favourable influence over trachoma, but the disadvantage of the method lies in the difficulty of securing an equal distribution over the surface of the conjunctiva. Again, a careless use of the powder may entail localised damage to the cornea. On the whole, therefore, I prefer the use of the remedy in stick.

Lapis divinus, as everybody knows, is a compound of sulphate of copper, alum, nitrate of potassium, and camphor, fused together and cast into convenient shape for the surgeon's use. It has been much extolled in trachoma, more particularly in chronic forms of that ailment, and the indications for its use are similar to those already described when speaking of bluestone. To my mind, however, it is inferior to the latter agent, and is certainly more painful. It has the mechanical disadvantage, too, of leaving small particles on the conjunctiva, and of thus setting up a sharp reaction. Notwithstanding these drawbacks, lapis divinus sometimes acts well in the

* Of late months I have used the precipitated sulphate of copper, prepared by adding alcohol to a saturated solution of that salt, and collecting and drying the precipitate.

presence of marked hypertrophy of tissue ; that is, in the second stage of the malady. The fact may be added that, in my opinion, it should not be employed when either pannus or corneal ulceration is present.

Lunar caustic I regard as the most useful agent next to bluestone. It is specially indicated in inflammatory conditions of the conjunctiva, more particularly when associated with active pannus or with ulcers of the cornea. There is no remedy, in my experience, which is so capable of reducing inflammatory symptoms as the nitrate of silver.

A patient, let us suppose, comes to us in this pitiable plight. He is pale and suffering, and obstinately refuses to face the light, which he tries to exclude by keeping the hand pressed closely over the eyes. His eyelids are tightly closed and swollen, their colour is pinkish-white, and they are veined by arborescent vessels. At the outer corner of his eyes there is a small excoriation which tells its own tale of long continued photophobia and lacrymation. On attempting to separate his eyelids, tears gush out, while complaints of pain and attacks of sneezing are common. His cornea is traversed by enlarged and tortuous vessels, and dimmed by the blemishes of ulcers, past and present. The conjunctiva of his lids presents a typical picture of trachoma. A solution of lunar caustic is the remedy for such a patient, and can be replaced by no other soever. Its daily application will speedily improve matters, so that within three weeks or a month the whole of the prominent symptoms will have disappeared, and his condition will be rendered tolerable, perhaps the first time for years. It is under circumstances like these that nitrate of silver becomes one of the most valuable weapons possessed by the surgeon.

In relapses, again, it is invaluable : one not infrequently sees acute inflammation subside and a cloudy cornea clear after a few days' use of the remedy. To be brief, lunar caustic is an excellent agent to keep, as it were, in reserve, so as to attack the acute or sub-acute symptoms that arise at some phase in the life history of almost every case of trachoma.

Nitrate of silver may be used, (*a*) pure, (*b*) "mitigated," as it is

termed, with various proportions of nitrate of potassium, and (*c*) in watery solutions of various strengths.

(*a*) In less recent times the pure caustic was generally used, and often followed by disastrous results, such as symblepharon and ulceration of the conjunctiva or of the cornea. Since the introduction of the mitigated stick, however, it has been abandoned. A few years ago I discovered by accident that there was a class of case in which the undiluted crayon effected a marked improvement. The cases in point are rebellious to ordinary agents, and are characterised by great vascularity and swelling of the conjunctiva, by profuse muco-purulent discharge, and by persistent photophobia and lacrymation. In three instances of this kind the pure lunar caustic was inadvertently applied. The mistake at once became apparent, and the conjunctiva was freely washed with a solution of common salt. Reaction was severe, and for some days the patients were unable to open their swollen lids, from which an abundance of discharge flowed. In process of time, however, the inflammatory symptoms subsided, and it was then found that marked improvement had taken place in the condition of the conjunctiva. Taking my cue from that experience, I have in some instances deliberately made use of the pure caustic to cases that resisted ordinary routine treatment. Special precautions ought, of course, to be taken. Thus, the crayon must be perfectly dry, and the conjunctiva free from moisture; excess of the nitrate must be removed by saline solutions, applied before the lids are suffered to return to their place. It might even be advisable to shield the cornea by means of the spoon-shaped nickel instrument, lately introduced²⁰¹ by Dr. Galtier, of Nimes. The after-treatment will include the constant application of cold to the closed eyelids, until the eschar produced by the silver has been thrown off. A second application of the undiluted caustic will be rarely needed. The escharotic agents in everyday use generally act well enough as soon as the inflammation produced by the strong silver has subsided.

(*b*) The mitigated stick, as already hinted, is prepared by fusing together nitrate of silver and nitrate of potassium in various pro-

portions. The strength usually selected in eye work contains one part of the former to two of the latter salt, and is now officinal under the name of *Argenti et Potassii Nitratas*. This remedy is still widely employed, although, personally, I seldom use it. It seems to me that just as much good can be effected by the application of the strong solutions. If the mitigated stick be employed, however, its potency should be reduced by subsequent washing of the conjunctiva with cotton wool dipped in water, which may or may not be saline. When tolerance has become established, this proceeding may be omitted.

(c) The watery solutions in common use contain 10, 15, and 20 grains of the nitrate salt to the ounce of distilled water, and are applied in the way already indicated. For general use, the ten-grain solution fulfils every purpose, and cannot be improved upon. In special cases—for example, those with much discharge—the stronger liquids may, of course, be employed, but the weaker solution has, practically speaking, displaced the others in my own work. The fact is, that by lengthening the period of exposure, the 2 per cent. solution becomes just as efficacious as the others, while it has the great advantage of not being likely to cause corneal damage.

The staining of the conjunctiva constitutes a weighty objection to the systematic use of silver nitrate. This result seldom comes about unless the applications are continued for some months, although at times I have seen it produced in the course of a few weeks. The membrane, in its palpebral portion, becomes at first of a light olive-green tint, which later deepens into various shades of grey or even black. The upper cul-de-sac remains for a long time free from discolouration. If the silver be continued, despite these signs, the bulbar conjunctiva gets affected, especially in its lower half, and the eye is thereby rendered unsightly. Later still, the cornea itself may become discoloured. Staining is due to the deposition of dark granules—probably of the albuminate of silver—not only in the lymphatic spaces of the conjunctiva, but also around its vessels. The particles, it may be noted, are not unlike those observed when a

photographic negative is examined under a low power of the microscope.

The stain is permanent; at least, I have never seen it alter, even although patients have remained for years under close observation. Attempts to get rid of the *argyria*, as it is called, have proved futile. The prolonged application to the conjunctiva of strong solutions of iodide or of cyanide of potassium, of hyposulphite of sodium, and of perchloride of mercury has produced, in my hands, no alteration worth mentioning.

Many practitioners are in the habit of neutralising excess of silver by the subsequent application of a solution of common salt to the conjunctiva. Two advantages are claimed for this plan—first, that the chances of staining are reduced to a minimum; secondly, that any risk to the cornea is thereby avoided. As to the first point, *argyria* is more closely connected, after all, with the number rather than with the strength of the applications; while as to the second, the cornea cannot be injured by the use of a ten-grain solution, which may be dropped with impunity over its surface. In point of fact, the flow of saline tears, at once excited by the caustic, is in itself sufficient to dispose of any surplus silver; a careful attendant, moreover, would take care not to use the remedy in excess.

From the foregoing statements it will be gathered that, as a general rule, I make no attempt to mitigate the action of the silver. The only exception is where active ulceration of the cornea co-exists with trachoma, in which case I think it advisable at first to weaken the action of the solution, and to prevent it coming into contact with the inflamed cornea. Later, however, it may be used without any such precaution.

To recapitulate, the two most serviceable remedies in trachoma are solid bluestone and a two per cent. solution of lunar caustic. The former is especially suitable for cases where secretion is scanty, and the conjunctiva, although much thickened, is free from marked redness and succulence. Pannus, unless of unusual vascularity, forms no bar to its employment, nor do corneal ulcerations, unless of active type. The silver solution, on the other hand, finds its

particular indication when pannus or ulcers complicate a trachoma, of which the characteristic features are great vascularity and abundance of discharge. More briefly still, copper is called for in chronic conditions, while in the acute or sub-acute silver is the more suitable remedy.

After the salts of copper and of silver must be placed those of mercury, of which a large number have been and are still used in trachoma.

Corrosive sublimate, an ancient remedy, has been extensively employed by me during the last nine years. At first I used it in the form of a half per cent. solution, but that was soon replaced by a one per cent. strength. It was applied to the conjunctiva daily, any excess being soaked up by means of absorbent wool. Its application caused comparatively little pain, and in many instances succeeded admirably. In order to effect a cure, however, the sublimate had to be applied for many months, and thus differed little from agents in more general use. At the same time, the one per cent. solution did exceedingly well in cases where there was marked infiltration and folding of the conjunctiva, whether associated or not with pannus. It often acted equally well in the first stage of trachoma.

Although unpleasant symptoms rarely followed the use of the sublimate, yet I once witnessed a curious and somewhat alarming effect. The facts of the case were these:—a 1 per cent. solution was applied to the left eye of a girl who suffered from acute trachoma. Half-an-hour afterwards the lids were found to be swollen, and when they were separated, a membrane was seen which almost completely concealed the eyeball. The membrane looked not unlike a piece of thin tracing paper, and was probably nothing more than discharge coagulated by the escharotic. At any rate, it disappeared within four hours, and the cornea sustained no damage.

In 1891, Mr. Kenneth Scott,²⁰² of Cairo, enthusiastically recommended a still stronger solution, namely, one that contained 4 per cent. of the mercuric salt. He applied the remedy once daily, and spoke of it as an “unfailingly effectual and rapid method of treatment.” He was indeed sanguine enough to assert that “a perfect cure is effected in at most six or eight weeks, but usually much sooner.”

These statements induced me to make a trial of the 4 per cent. solution, but I regret to say that the results of my experience did not tally with those related by Mr. Scott. Many of my cases, it is true, showed marked improvement, not only in the state of the conjunctiva, but also as regarded complications, such as pannus. Although I have followed this treatment in sixty eyes, during periods that have ranged from seven days to twelve months, I have succeeded in curing very few of them. On the other hand, in six cases I have seen a loss of corneal substance follow the application of this potent liquid, notwithstanding the fact that excess had been in every instance removed by a cotton swab. The production of conjunctival sloughs, too, is relatively very common. On the whole, then, a four per cent. strength possesses, to my mind, no marked advantage over the weaker solution (one per cent.).

At this point some reference may be made to a method that has been of late much employed on the Continent—viz., that of bringing sublimate solutions into intimate contact with the conjunctiva by friction with cotton wool. The brothers Keining,²⁰³ who published their experiences with this plan in 1890, seem to have been the first to recommend its general adoption. Their method was to rub the diseased membrane with wool steeped in 1 in 2,000 sublimate solution, and to repeat the process once or twice in the twenty-four hours. They also used, several times a day, a weaker solution, applied in the ordinary way to the conjunctiva. Hippel²⁰⁴ has reported good results from a trial of the method on upwards of 300 patients. Chevallereau²⁰⁵ substituted a 1 in 500 solution, and claimed that the disease was cured in six or eight bi-weekly applications. There is an obvious disadvantage about the plan, namely, the difficulty of getting the liquid into contact with the superior fornix. To remedy this weak point, Falta²⁰⁶ has devised a special instrument ("sublimat-massage-pincette") to carry the medicated wool into the cul-de-sac.

My experience of *frottage*, as the plan is called, is too limited to permit of my forming any definite conclusions as to its value. Its theory of action seems, however, to be rational, and I have certainly

seen considerable improvement result from the treatment. It is best suited for cases where hypertrophy of tissue is a marked feature, and where granulations are large and numerous. It appears to be a really useful accessory measure, although it is scarcely likely to displace the escharotics in common use.

One more method of applying corrosive sublimate remains to be mentioned. I refer to its use as a crayon, made of one part of the salt fused with four parts of nitrate of potassium, a combination introduced by me²⁰⁷ in 1886. The points (as shown by analysis) contain a large proportion of potassium chloride to a much smaller proportion of mercuric chloride. They have a white porcelainous appearance and a smooth surface, and are readily soluble in water and other fluids.

When applied in this form, the perchloride often proves of great benefit in the second and third stages of chronic trachoma, either with or without pannus. It also serves as an excellent alternative when other agents are losing their power in any given case. It is, however, altogether unsuited for the treatment of the first stage, and of acute phases of the disease.

The sublimate point should be used daily, and at first its action should be controlled by swabbing the conjunctiva after treatment with a morsel of damp cotton wool. As the membrane becomes more tolerant, this after-washing may be omitted.

Struck by the antiseptic properties claimed for sal alembroth, I had that agent cast into crayon-form, and its strength reduced by the addition of three parts of the nitrate of potassium. In actual practice, however, conjunctival sloughs were nearly always produced, and so after a brief trial, I abandoned its use.

Another agent that I have tried on a limited scale is the biniodide of mercury, under the form of a preparation that bears the trade name of "Iodic-Hydrarg." It is a heavy, lemon-coloured powder, readily soluble in water, and said not to precipitate albumen. With its asserted antiseptic properties everybody is by this time familiar. I have used the biniodide in strengths varying from 1 per cent. to 4 per cent., applied daily to the palpebral conjunctiva. It has given

me good results, as a 2 per cent. watery solution, in sub-acute cases of trachoma, and it has the advantage of causing but slight pain. Broadly speaking, its action is comparable with that of the ten-grain solution of silver nitrate. Upon the whole, it appears to merit further investigation.

During the last two years, I have conducted a series of experiments with the cyanide of mercury, a salt of powerful antiseptic properties, and easily soluble in water. Trials have been made with aqueous solutions that have ranged in strength from 2 per cent. to 12 per cent., and a 5 per cent. proportion has been finally selected as the most generally useful. The cyanide, which is applied once or twice daily, causes scarcely any pain, and never, so far as my observations go, injures the cornea. Conjunctival sloughs, however, are now and then seen. But in all of these respects it contrasts favourably with corrosive sublimate. It may be employed not only in chronic, but also in acute or sub-acute trachoma, and seems to act best in the presence of abundant secretion. The results obtained with cyanide, although not strikingly rapid, have been, on the whole, of an encouraging nature, and such as to merit trial on a more extended scale.*

My experiences with tincture of iodine, applied to the conjunctiva in the way recommended by Fromont²⁰⁸ upwards of forty years ago, have not induced me to believe that that agent possesses any advantage over others in everyday use.

Iodoform—which, theoretically, seemed to promise much—has proved disappointing in actual practice. I have dredged it freely over the conjunctiva for weeks at a time, but without obtaining any definite results. Nor has the use of iodoform as an ointment succeeded any better. In a word, the drug appears to have little if any influence over trachoma. Idol, too, has proved useless in my hands.

Quinine, so far from yielding good results, has actually done damage to every case in which it was tried. It was used on four

* Mr. Scott (*Brit. Med. Journ.*, London, Sept. 15, 1894) has also employed this agent. He recommends the daily application to the conjunctiva of a four per cent. solution, in addition to which he uses a quarter per cent liquid as a collyrium.

occasions, and was dusted over the exposed conjunctiva, both of upper and of lower lids. The application caused severe pain, and ulcerative keratitis was set up by the treatment. Under these circumstances, I did not feel justified in extending the method to other cases.

In the earlier days of my connection with trachoma, many trials were made with boric acid, finely powdered and dusted over the everted lids. The method did not come up to my expectations, and was consequently abandoned. In 1889, Costomiris, of Athens, combined energetic friction with the use of the powder—that is, he employed a kind of massage. The idea was soon taken up by others, and conflicting statements were made with regard to the value of the plan. Thus, it was condemned by Christovitch, and praised by Vignes, Rohema, Levesque-Lacroix, Holmes, and by W. M. Beaumont.

I adopted the modified plan after reading a communication made to one of the medical journals by the last-named observer.²⁰⁹ The details of application were these:—The acid was freely dusted over the conjunctiva, and then rubbed into the interstices of that membrane, for about ten seconds, by the pulp of the forefinger. In the first instance, eight cases of follicular conjunctivitis were selected for trial, and the applications were continued for periods that varied from one to four months. The results obtained were not satisfactory. Thus, five of the patients were not benefited; once the discharge was lessened, and once the associated congestion reduced; while in the eighth case alone some definite improvement was noted.²¹⁰ The method was next applied to a dozen patients suffering from trachoma, but the results were no better. In my hands, therefore, the boric acid treatment has yielded practically negative results.

During the last few years, boroglyceride (a patented preparation) has been recommended, especially by American surgeons. It is used as a solution, the strength of which may range from 20 per cent. to 50 per cent., and is applied to the conjunctiva in the ordinary way. The boroglyceride is an unirritating remedy, and now and then does good in acute disease. In the first stage of

trachoma, also, it may be employed to pave the way, so to speak, for more potent agents. So far as I have seen, it is useless, however, in other stages of that malady.

Alumnonol is a sulphone salt of aluminium lately introduced into practice. Remarkable astringent and antiseptic properties are claimed for that substance, which has the further advantage of not coagulating albumen, and hence of penetrating animal tissues readily. The agent seemed a promising one in trachoma, and I was induced to give it a trial. It was dusted over the palpebral conjunctiva once a day, and the lids were then permitted to return to their place without attempting to remove any of the powder. This plan was carried out on twelve cases of chronic disease, but without improvement, except as regards a slight lessening of discharge. Next, the mode of application was modified, in that the alumnonol was rubbed into the diseased membrane by the pulp of the forefinger. The results, however, were not more satisfactory than those previously obtained: neither the organic changes that lie at the root of the disease nor the pannus showed any definite improvement.

Tannic acid exerts a favourable influence over the acuter forms of trachoma, especially when accompanied by profuse discharge and chemosis. In such cases, the lids may be everted, and the conjunctiva brushed once or twice daily with the *Glycerinum Acidi Tannici* of the British Pharmacopœa. With regard to chronic disease, tannic acid has proved disappointing in my experience. The acid, both pure and mixed with boric acid (as recommended by Wickerkiewicz²¹¹), has been dusted over the conjunctiva for lengthened periods, but without producing any marked benefit. In short, although persistent discharge may be often reduced by the use of these preparations, I have never known their effect produce any marked change for the better in the general conditions.

In the opinion of De Beck²¹² and of many other writers, the preparations of lead should on no account be used in eye affections. They nevertheless exert a favourable influence upon many cases of trachoma. I have not tried their use by the methods of Buys and of Gouzée, already alluded to in these pages, inasmuch as they have

been condemned after an extended trial by Nettleship.¹⁰⁷ In the experience of that careful observer, the application of powdered acetate of lead was followed by ulceration of cornea and of conjunctiva, and, in one instance, by organic entropion.

The preparation of which I have had the most experience is the one recommended by Vetch and by many of the earlier writers—to wit, the undiluted *Liquor Plumbi Sub-acetatis*. The liquid is applied to the conjunctiva, in the usual way, once in the twenty-four hours, and any surplus soaked up by means of absorbent wool. In dealing with the first stage of trachoma, this method has yielded good results, and the indications for its adoption would seem to be—(a) marked redness and swelling of the palpebral conjunctiva; and (b) the presence of free discharge. In the third, or cicatricial stage of the disease, however, lead appears to do good, and the *Liquor Plumbi Sub-acetatis Dilutus* (P.B.) may be often used instead of the stronger solution.

The use of lead salts in eye affections, it should never be forgotten, has its important limitations. Thus, it is absolutely contraindicated in presence of corneal complication, whether in the nature of ulceration or pannus. If lead be applied to an eye with ulcerated cornea, a deposition of the salt will almost certainly take place, and a disfiguring opacity or incrustation will result. This remedy, therefore, should never be used until careful scrutiny has satisfied the surgeon as to the transparency of the cornea and its freedom from ulcers. Under no circumstances, should it be given to a patient for home use.

In 1890, Professor Stilling²¹³ drew attention to the antiseptic properties of the aniline colours, among which he specially praised methyl-violet, commonly known nowadays as pyoktanin ($\pi\hat{\alpha}\nu$ = pus, and $\kappa\tau\epsilon\iota\nu\omega$ = to destroy). He claimed many advantages for that substance: that it was, for instance, devoid of toxic action, very diffusible, did not coagulate albumen, and, last but not least, that its antiseptic powers were considerable. Stilling used pyoktanin in the various forms of powder, ointment, crayon, or solution. By the energetic employment of the crayon, he claimed to have obtained

good results in some slight cases of "granulations." At the same time, he candidly admitted that the best way had yet to be discovered of using pyoktanin in severe trachoma.

I conducted some experiments with the aniline colours, using methyl-violet in its ordinary commercial form, and sprinkling it over the conjunctiva. The results, however, were far from encouraging, and after a short trial, the agent was therefore abandoned.

It has lately struck me that perhaps full justice was not done to the remedy, more especially since the ordinary samples of commerce were employed. So I determined to make further experiments, but this time with the crayon recommended by Stilling, and manufactured by Messrs. E. Merck & Co., of Darmstadt. Three obstinate cases of chronic trachoma were selected for trial, and the crayon energetically rubbed daily over the conjunctiva of the lids. The treatment was continued for six months, but without apparent benefit.

A word may be next devoted to carbolic acid, an agent that has been extolled more than once in the treatment of trachoma. It was used mixed with glycerine by Risley, while in undiluted form it has been recommended, among others, by Chisholm in America, and by Treacher Collins²¹⁴ in this country. I have made a fair number of trials with the liquefied acid of the Pharmacopœia, applied daily to the everted lids, which were afterwards doused with a stream of water. This treatment did not prove specially painful, and rendered good results in chronic cases where scar-changes were prominent. Carbolic acid is, however, a powerful agent, and unless used with considerable care, might readily cause a good deal of mischief to the cornea. It should, therefore, be reserved for cases of special difficulty.

Points of pure alum and of sulphate of zinc—together or singly—have been recommended in trachoma. It has been suggested that they would be found useful when the coarser symptoms of disease had been subdued by more powerful agents. All three substances have been tried by me, for the most part in chronic cases, but have not afforded satisfactory results. They are not to be compared for a single moment with bluestone.

We may sum up this discussion by saying that of the multitude of agents that may be used in trachoma there is not one of which we may assert that its employment will be followed by a speedy cure. To attain success, each and all of them must be diligently applied for a period to be measured, not by days or weeks, but rather by months or by years. For general use, there is nothing equal to bluestone in chronic, and to a two per cent. solution of lunar caustic in acute cases. Of the other remedies, the preparations of mercury and of lead alone appear to be really useful, and may be applied, for the most part, both in the second and third stage of the malady. Tannic acid and boroglyceride are serviceable in acute disease, and possibly in the first stage of chronic trachoma. Brushings with "iodic-hydrarg." and with mercuric cyanide, as well as "frottage," must be included among methods whose value is not yet fully ascertained.

In conclusion, a few words may be added with regard to the treatment of acute and sub-acute trachoma, the sovereign remedy for which is nitrate of silver. A two per cent. solution of that salt is painted over the everted conjunctiva once or twice daily. There need be no hesitation about at once resorting to the silver in mild cases, but in those of a more severe type it is generally advisable to wait for twenty-four or forty-eight hours—that is, until secretion has become fairly free—before making the application. In the meantime, discharge, even although scanty, must be removed by frequent washings with perchloride lotion (1 in 5,000), or with chlorine water. A useful accessory measure, from which the patient often derives great relief, is the constant application of cold to the closed lids. Should ulceration of the cornea set in, a few minims of a 1 per cent. solution of the sulphate of atropine should be dropped into the conjunctival sac three or six times a day, so as to dilate the pupil fully. It is worth while noting, however, that atropine seldom does any good unless the cornea be involved, and it may, indeed, do harm. For the rest, the patient should be confined to bed in a well ventilated room until acute symptoms have subsided, when the systematic use of the copper stick should be commenced. Acute trachoma, it should be borne constantly

in mind, is one of the most contagious of eye affections. Absolute measures of isolation, therefore, ought to be enforced in every case. If one eye alone be attacked, the other should be guarded against infection by the familiar watch-glass and sticking plaster apparatus known as "Buller's shield."

ACCESSORY MEASURES OF TREATMENT.

Lotions, however carefully applied, are inadequate for the cure of trachoma—a malady that always demands stronger remedies. At the same time, when used in the form of mild antiseptic solutions, they fulfil a useful purpose. Thus, they not only wash away discharge, but they also have a cooling and astringent action that cannot fail to be grateful to the patient. It is an excellent routine practice, therefore, to apply them to the conjunctiva thrice or oftener during the twenty-four hours.

One cannot commend the ordinary way of using a lotion, which is by allowing a few drops to fall into the lower cul-de-sac. The proper plan is to evert the lids fully, and expose them to the action of the remedy for at least fifteen seconds. During this time, the liquid should be made to find its way into the recesses of the membrane by slight movements of the nurse's fingers. It need scarcely be added that every trace of discharge must be carefully removed from the conjunctiva by means of the lotion.

As a collyrium for general use there is probably nothing better than an eighth of a grain of corrosive sublimate dissolved in an ounce of distilled water, with the addition of a small quantity of ammonium chloride. The latter, besides increasing the solubility of the mercuric salt, also prevents the formation of albuminate of mercury, when the collyrium comes into contact with the conjunctiva. This solution, it is interesting to note, is almost identical with that recommended by Ware and by many of the earlier writers. Another useful and unirritating lotion is a saturated solution of boric acid. A favourite prescription of mine is the old fashioned "Yellow Lotion" of the Austrian Pharmacopœa, which is prepared according to the following formula:—Ammonium chloride, 0.5, and zincic

sulphate, 1·25 parts, dissolved in 200 parts of distilled water. Next, camphor, 0·4, is dissolved in 20 parts of absolute alcohol, and 0·1 part of saffron is added to it. The two solutions are then mixed, allowed to stand for twenty-four hours, and filtered. Yellow lotion generally causes some considerable smarting when first used, but the patient soon becomes accustomed to it. Chlorine water—much used by Von Graefe—has been lately praised by Lawford,²¹⁵ and seems likely to come into general use again. It certainly has powerful antiseptic properties; but it is an unstable agent, and must, therefore, be freshly prepared. Its application, too, now and then gives rise to considerable pain. In fact, the list of these lotions might be extended to an almost indefinite length, but it must suffice for our present purpose to mention a few of the more generally useful, viz.:—Sulphate or sulpho-carbolate of zinc (grains 1 to 2; water, 3j), lapis divinus (grains 2 to 4), chloride of zinc (grains 1 to 2), alum (grains 2 to 5), copper sulphate (grains 2 to 4), carbolic acid (grains 5 to 10), permanganate of potash (grains, 10-20), or of zinc (grains 1-2). Equal parts of tincture of opium and distilled water form a useful collyrium, especially in chronic cases.

Blisters and setons are mentioned only to be condemned. They are never needed in trachoma, pure and simple. The darkened room, also, is quite unnecessary. It is capable, indeed of doing considerable mischief by depressing the patient.

Atropine ought never to be employed in the absence of certain definite indications, such as inflamed pannus or ulcerative keratitis. The practice of instilling atropine in uncomplicated trachoma is, to my thinking, a bad one. The drug often causes increased irritation, to say nothing of the inconvenience attending a widely dilated pupil and a paralysed ciliary muscle. Similar considerations apply to the indiscriminate use of cocaine.

Although we may not believe with Mackenzie,⁴⁴ that constitutional symptoms form part and parcel of trachoma, still every practical surgeon recognises the importance of measures calculated to improve the general health. Hence every attempt should be made to raise to the highest possible pitch the bodily condition and environment

of the patients. Tonics, as quinine and strychnine, should be administered to the weakly, iodine to the strumous, iron to the anæmic, and cod-liver oil, in liberal doses, to the badly nourished. Plain but good food is indicated, and regularity of meals should be insisted upon. For all cases, an abundance of fresh pure air, both indoors and outdoors, is a matter of first necessity. Dormitories must be freely ventilated, and a liberal amount of floor-space be allotted to each patient. In short, every precaution should be adopted to improve, not only the bodily condition, but also the sanitary surroundings of those suffering from trachoma.

A few authors look upon scrofulosis as an important factor in the production of trachoma. Their idea is that the tissues of strumous individuals form, so to say, an excellent nidus for specific infection. Truc²⁴⁵—a strenuous advocate of this view—goes so far as to assert that all trachomatous patients are scrofulous, and that the severity of the eye lesion is directly proportionate to the degree of scrofulosis. Pignatari²⁵² states that the gravest cases of trachoma “are almost invariably found in scrofulous or tuberculous subjects.” This theory, however, is open to grave objections, and to more than one fallacy. In the first place, some of the signs that may be classed as “strumous” are to be met with among those in perfect health. Take, for instance, the question of glands. The great majority of children have glands that may be felt, especially in the neck and groin, where it is not too much to say they can always be detected by the educated touch. Yet it would be obviously absurd to brand all such patients as scrofulous. In point of fact, the diagnosis of struma depends upon a combination of symptoms, of which, perhaps, the most suggestive are the coarse hair and features, the muddy skin, the decayed teeth, the enlarged and corrugated upper lip, the markedly swollen, lymphatic glands, the characteristic scars, the discharging ear, the prominent and tumid belly, and the tendency to pustular cutaneous eruptions of a relapsing nature. In my judgment, the presence of any one of these signs is not in itself sufficient to warrant a diagnosis. To vary the statement, we are faced at the outset by the obvious fallacy that different surgeons adopt different standpoints

as to what constitutes scrofula. In the second place, I have never been able to convince myself that trachoma is relatively more common among the undoubtedly scrofulous than among the healthy, or, what comes to much the same thing, that the former class is more prone to trachoma than any other. Personally, I do not feel inclined, therefore, to attach any great importance to the diathesis as a predisposing agent.

In bringing this paper to a close, it may be as well to state clearly that I am in no sense an advocate for surgical interference in the common run of cases. Broadly speaking, I should say that quite 75 per cent. of the patients recover under ordinary treatment by escharotics. Those who decry the use of such agents appear to do so without valid reason. The method is certainly tedious, but success can always be obtained, provided the applications are made with sufficient frequency and in an efficient way. In the remaining 25 per cent. of cases, however, the course of the disease may be shortened and its severity reduced by a timely resort to surgical measures. To reject operation entirely is, in my opinion, as unscientific as to fly to it on every occasion. In other words, there exists in the treatment of trachoma a golden mean, on the due recognition of which the success of the surgeon and the future happiness of the patient will greatly depend.

SUMMARY.

1. Both surgical and escharotic means have been practised in trachoma since time immemorial.
2. For general purposes, bluestone and lunar caustic are the most trustworthy escharotics.
3. In properly selected cases, surgical treatment should be employed, but not to the exclusion of other therapeutic measures.
4. "Expression" is an operation of great value, and deserves a permanent place in the treatment of trachoma.
5. Excision of the upper cul-de-sac, performed on the principles laid down in this essay, is free from danger, immediate or

remote. It is worthy of trial in cases of trachoma that resist ordinary methods of treatment.

6. A combination of surgical and of escharotic methods not infrequently forms the speediest, the safest, and the most rational means of attacking the disease.

THE COMPLICATIONS OF TRACHOMA AND THEIR TREATMENT.

TRACHOMA rarely runs its course without complication of some sort; it is, moreover, sometimes followed by such remote results as trichiasis and ptosis. In the following pages its chief complications and sequelæ will be described, and their treatment briefly sketched out.

PANNUS AND ULCERS OF THE CORNEA.

Pannus and ulcers of the cornea are not only the most important but also the most frequent complications of trachoma. They are present in at least 25 per cent. of the cases, and, although they may be met with apart from one another, yet as a rule they occur together. It will be convenient, therefore, to describe both conditions under a common head.

Pathologically, pannus may be defined as a small-celled infiltration, containing vessels of new formation, and affecting in the first instance the superficial portions of the cornea. Later, the infiltration may invade Bowman's membrane, and, passing through that structure, penetrate the deeper layers of the cornea. At a still later stage, Bowman's membrane may be wholly or partly destroyed.

Clinically, there are many degrees of pannus, which varies from a slight opacity, invisible except by artificial illumination, to a condition in which the cornea looks as though it were covered with a red rag. In former times the adjective *tenuis* was used to indicate a thin layer of opacity, in which few vessels were present; *crassus*, a thicker and more advanced condition; *sarcomatosus*, a fleshy state of the cornea; while *siccus* was applied to a pannus that had undergone retrogressive changes.

Attentive examination of the healthy eye shows that overlapping, as it were, the upper part of the cornea, is a greyish crescent, the concavity of which is directed downwards. This arc is continuous with the sclera, and on using a magnifying glass, may be seen to be intersected with fine parallel vessels derived from the limbus. Its height varies in different eyes, but seldom exceeds 1.25 mm., and its details of structure can be best made out after the pupil has been dilated with some mydriatic agent. One should note that in the normal condition its lower edge is perfectly sharp.

The earliest signs of pannus, so far as I have observed them, are connected with the structure just described. The lower edge of the "scleral arc" (as we may term the crescent) becomes irregular—so to speak, toothed—by the outgrowth of small pointed processes which run into the cornea. The vessels normally present shoot out and accompany the grey lines. While these changes are going on, or even sometimes before they are observed, small red spots, closely resembling phlyctenulæ, may be noticed at the upper part of the sclero-corneal junction, and they appear in one or more crops. Meanwhile, fingers of opacity push their way farther and farther into the cornea, insinuating themselves between the anterior elastic lamina beneath and the epithelium above. Vascular extension keeps step with the other processes, and thus more and more of the cornea becomes opaque. Neighbouring extensions from the "scleral arc" coalesce, so that late in the history of the case the pointed processes are replaced by a more or less continuous sheet of opacity.

The relative development of vessels, on the one hand, and of opacity, on the other, varies much, not only in different cases, but also at different times in one and the same case.

When fully established, however, a typical pannus covers the upper third or more of the cornea, to which it gives a peculiar and characteristic appearance. With the naked eye, few or many enlarged vessels, continuous with the posterior conjunctival system, may be seen to branch out in arborescent fashion into a greyish opacity. This vascular web is somewhat raised above the level of the normal cornea, the epithelial covering of which is projected into small

elevations and ridges, or, in more direct phrase, is uneven. So marked is this latter appearance that in many instances the cornea, when viewed by reflected light, looks as if it had been sprinkled over with grains of fine sand. The colour of the pannus will obviously depend upon the relative development of vessels and opacity, and may range from a cloudy grey to a dull red. At the same time, it is by no means uncommon for colour, like density, to vary in different parts of the affected patch.

The lower border of a pannus is seldom even approximately horizontal. On the contrary, it usually takes the form of a curved line, the convexity of which is directed upwards or (more commonly) downwards. Sometimes the vascular patch crosses the cornea obliquely, so that it may seem to be almost confined to one or other of the two superior quadrants of that structure.

As will be noticed later, the free edge of a pannus forms the favourite site for ulceration, and it is the rule to find one or more opacities in that situation. They may be large or small, and a characteristic appearance is that of several nebulæ, united into a pattern that may be roughly compared with a string of beads. This "necklace" form, as we may term it, is doubtless due to a union between neighbouring ulcers. The central nebulæ—sometimes observed in a cured trachoma—are to be explained by ulceration that has taken place along the free border of a pannus. The last-named condition has cleared up, whereas the results of the ulceration have remained in permanent evidence. For my own part, I am in the habit of regarding such central opacities, especially when associated with a toothed scleral arc, as good evidence of the previous existence of pannus.

That part of the cornea which is free from pannus should, theoretically speaking, remain clear. Practically, however, that is seldom the case. It is the rule to find a variable number of minute ("pin-point") opacities scattered over its surface. Focal illumination is often needed to demonstrate their existence.

Such symptoms as congestion of the conjunctiva bulbi, spasm of the orbicularis, photophobia, and lacrymation, are rarely altogether

absent in typical cases, but it is important to note that they vary much in intensity, and seldom correspond with any accuracy with the objective signs of disease. Some pain, too, may be complained of, although, as a general rule, it is not of a severe type.

The defects of sight produced by pannus will depend partly on its position, and partly on its density. Thus, a patient with a dense pannus involving the upper fourth of the cornea will probably read the smallest line on Snellen's test types—that is, his distant sight will be normal. Whenever the process encroaches on the pupillary area* of the cornea, however, vision must then of necessity be more or less impaired. In universal pannus all useful sight may be destroyed, the patient being able to distinguish nothing except the largest objects.

To explain the production of pannus is not so simple a matter as might at first appear. By Saunders and others it was supposed to result from the friction of a roughened upper lid; that it was, in other words, of a protective nature, and destined to shield the cornea from injury. This plausible explanation appeared to meet the circumstances of the case, and was adopted generally. It seemed to be supported by the known fact that pannus always began in the upper part of the cornea—that is to say, in the precise place where a rough upper lid might be expected to cause the greatest amount of friction. Certain clinical objections, however, were before long raised to this theory. It was pointed out, for example, that no invariable relation existed between the state of the upper lid and of the cornea: that well developed pannus might be associated with a comparatively smooth conjunctiva, while coarse granulations might give rise to no pannus at all.

Mackenzie⁴⁴ accepted the explanation as accounting in great measure for the condition of the cornea, but he also stated that pannus was partly due to "the same inflammation which has ended in hypertrophy of the papillæ of the palpebral conjunctiva" (p. 644). From his time onwards many authors have adopted, with

* By the expression "pupillary area" is meant that portion of the cornea which lies in front of the pupil.

slight modification, this dual theory of causation. Pannus co-existing with a notably rough upper lid was spoken of as "traumatic," while in other instances it was regarded as an extension from the upper fornix, the malady having travelled to the cornea by means of the conjunctiva of the globe.

Pannus, as well known, comes on during the early growth of trachoma, and practically never arises in the cicatricial stage. These facts are difficult to reconcile with a "traumatic" theory of origin; for the upper lid is surely more likely to do mechanical damage to the underlying cornea when seamed by tough scars than when merely thickened by sago grains and papillary over-growths.

From a pathological point of view, there is a striking resemblance between trachoma of the conjunctiva and pannus of the cornea. Thus, the central point in each affection is a diffuse infiltration with small cells of the nature of lymph corpuscles. Further, local accumulations of these cells occur in both structures, constituting, in the conjunctiva, the "granulations," and in the cornea, those elevations already described. Blood vessels of new formation are constantly met with in both affections. There is, then, a practical identity of pathological products; but the likeness between trachoma and pannus by no means ends there. In both cases a certain proportion of the cells become converted into fibroblasts, and form cicatricial tissue. This is equal to saying that, besides being histologically similar, the two processes terminate in a similar manner.

Developmentally, again, the superficial layer of the cornea is homologous with the conjunctiva; while, clinically, we know that the two structures are often involved in a common inflammation, *e.g.*, phlyctenular disease.

According to a modern view—that is fast gaining ground—pannus is simply trachoma affecting the superficial layers of the cornea. Sleeping or waking, more or less of the latter structure is covered by the upper lid, and it is surmised that direct contagion lies at the root of the matter. Mechanical causes play merely a secondary

rôle: a shaggy upper lid, it is thought, may detach morsels of corneal epithelium, and in that way cause breaches of continuity, through which organisms effect an entrance.

Granting that pannus and trachoma are one and the same disorder, it has always seemed to me that the cornea may become infected in two distinct ways. The first is the one above outlined, of the general truth of which I entertain no doubt whatever. The second, however, is of a somewhat different nature, and assumes a certain analogy between the spread of trachoma from conjunctiva to cornea, and the dissemination of malignant growths by metastasis. There is an anastomosis between the vessels of the inner surface of the upper lid and those of the superior cul-de-sac, while the latter (posterior conjunctival arteries), again, form the main supply to the bulbar conjunctiva. The vascular loops that encircle the cornea are derived from the posterior and the anterior conjunctival vessels. Consequently, there is no anatomical reason why trachoma cells—or, possibly, micro-organisms—starting from the upper lid or superior fornix, should not eventually find their way through the posterior conjunctival system to the limbus. At that place the “scleral arc” might conceivably act as a kind of filter to detain the transported cells, which would form the starting point of fresh growths. Cells and vessels would penetrate the cornea, making use, as Fuchs has suggested, of the passages that naturally exist for the circulation of lymph, or, possibly, of the cone-like offsets which, according to Alt,²⁵³ are possessed by the marginal blood vessels.

This embolic theory, as it may be called, would certainly reconcile a number of conflicting facts. There would be no difficulty in explaining why, with a smooth upper lid, pannus should co-exist with a diseased superior fornix; why the vascular web invariably commences in the upper part of the cornea, and spreads from the limbus; and why the development of pannus is so often preceded by an eruption of small reddish masses at the upper sclero-corneal junction, and by injection of the posterior conjunctival vessels. Furthermore, the sudden onset of pannus which is now and then observed, could be more easily explained by embolism than by the

existing theories. In short, metastasis, although not demonstrated experimentally, seems to be a rational and simple way of explaining the association of pannus with trachoma.

The clinical history of pannus may be summed up in a few words. With systematic treatment of the conjunctiva, it, for the most part, pursues an unbroken course towards recovery, either partial or complete. To this general rule there are two important exceptions, *viz.* :—relapses and ulceration.

Relapses make their appearance suddenly, and are usually discovered the first thing in the morning. They seem to be closely dependent upon meteorological conditions, such as increased velocity of wind, or excessive humidity of atmosphere. So far as my investigations go, barometric variations appear to exert but slight influence in the causation of relapses, a remark that also applies to direction of wind and to temperature. The tendency to relapse is peculiar to certain cases, and it lasts, moreover, for a limited period only in the life-history of any particular patient.

The usual signs of a relapse are these:—the bulbar conjunctiva is suffused, and the palpebral conjunctiva becomes redder and rougher and thicker. A pannus, the condition of which has perhaps improved until scarcely a trace of redness remains, becomes gorged with blood, while few or many vessels may be seen in its substance. Separate foci of opacity make their appearance, and occupy not merely the tissue of the pannus, but also the cornea below it. In a couple of days or so they lose their epithelial covering, and break down into small ulcers, which stain a vivid green with fluorescine. The separate dots of infiltration sometimes define the limits of a pretty large area, of which all the epithelium may be shed. The iris is spasmodically contracted, and the patient complains of more or less pain. The inflamed eye dreads the light, and waters copiously.

If such a case be left without treatment, or be treated with mild astringents merely, the symptoms will increase. Thus, the pannus vessels will encroach upon more and more of the cornea; the opaque deposits will become larger and more numerous, and in many

instances will coalesce; and sight will get worse from day to day. I have seen a cornea, previously almost clear, get cloudy in every part, so that the iris was quite concealed, in less than a week, the vision being reduced to simple perception of light.

Suitable treatment, however, will speedily alter the whole aspect of the case. An attempt should be made to dilate the pupil by atropine, and to soothe pain by cocaine. My favourite prescription contains atropine, 1 part; cocaine, 5 parts; and vaseline, 100 parts; the alkaloids being dissolved by the aid of gentle heat. Of the ointment, a morsel is put into the inflamed eye two to six times a day, according to the intensity of the symptoms. Instead of ointment, a solution of sulphate of atropine (grs. four to the ounce) may be used. Eserine has been recommended, but does not, in my experience, act so well as atropine. But the key-stone of success lies in the methodical application of astringents, notably a 1 per cent. solution of silver nitrate, to the palpebral conjunctiva. For the rest, the eyes should be protected from light by means of a paper shade, and the patient allowed to take outdoor exercise.

Ulcerative keratitis is the second complication. The usual condition is for one or more small ulcers suddenly to make their appearance at the free edge of the pannus, lying partly on it, and partly on the cornea beneath. More rarely, ulceration attacks the tissues of the vascular web itself, so that isolated points will be stained a vivid green when a solution of fluorescine has been dropped into the eye. These minute losses of substance probably result from a breaking down of the cellular exudation of pannus. The treatment recommended for inflamed pannus is equally suitable for ulceration.

There is a special form of ulceration that may be mentioned in this connection. Although it may exist alone, yet as a general rule it is associated with pannus. The ulcer usually lies at the junction between the upper and middle thirds of the cornea, and is accompanied by remarkably little re-action. The patients, for instance, rarely complain of pain, and photophobia is observed merely on

awaking in the morning ; the eye shows scarcely a trace of redness. The ulcer itself varies a good deal in size, and may be so transparent as to escape notice unless a careful examination be made. Its edges are often rounded, and its funnel-shaped appearance often suggests the idea that a piece has been bodily scooped out of the cornea. It may be shallow or deep. Its outline is generally oval, and its long axis often follows exactly the lower edge of the pannus. Instead of one such ulcer there may be several, which at a later stage unite with one another to produce the "necklace" pattern previously described. The course of these ulcers is essentially chronic, and they sometimes take months to heal. Indeed, they frequently leave permanent evidence of their existence in a flattened cicatrix, or "facette," as it is commonly called.

As to treatment, reparative processes should be stimulated by the use of an ointment containing either the yellow oxide of mercury or the ammoniated mercury (1 per cent. to 4 per cent.). The medicament should be placed in the lower cul-de-sac by the aid of a small camel hair brush, and then brought into intimate contact with the ulcer by gentle friction through the closed lids. Matters may be sometimes hastened by applying cocaine and then touching the ulcerated surface with tincture of iodine, a process that need not be repeated more than once or twice. Systematic treatment of the trachoma must also be rigorously carried out, and, upon the whole, copper suits these cases admirably.

Although a surgeon must always feel reluctant to operate upon any eye that has an unhealthy conjunctiva, yet there are certain rare cases of trachoma which call for paracentesis of the cornea. Thus, the ulcers associated with that disease are now and then accompanied by paroxysms of intense pain, which prevent sleep, and which ordinary treatment is powerless to relieve. Under such circumstances, I have tapped the anterior chamber not only with marked relief to the prominent symptom, but also with the result that remedies which formerly did no good acted well enough a day or two after the operation.

Paracentesis may be performed under cocaine, although in young

children or in timid subjects a general anæsthetic is advisable. The patient is recumbent, and the surgeon stands behind his head. After a speculum has been inserted between the lids, the eyeball is steadied by means of fixation forceps. A broad cutting needle (or a narrow angular keratome) is then pushed through the extreme visible periphery of the lower and outer quadrant of the cornea, and thereby made to enter the anterior chamber. During the making of this puncture the instrument must be held in such a way that its point is perpendicular to the surface of the cornea, but as soon as it can be seen in the anterior chamber, its handle must be depressed so that its blade lies parallel to the plane of the iris. If the first precaution be neglected, the needle may pass between the lamellæ of the cornea, instead of into the anterior chamber, while if the second be omitted, there will be a risk of wounding the iris or the lens. After the instrument has made an external wound, 3 mm. or so in length, it is slowly and cautiously withdrawn from the eye. The aqueous generally escapes during this stage, but should there be any difficulty in that respect it may be evacuated by pressing upon the posterior lip of the incision with a small probe or with the needle itself. In case the iris slips forwards with the escaping fluid, it must be replaced by means of a tortoiseshell spatula.

The anterior chamber refills in a few hours. Generally speaking, one operation suffices to relieve pain, but it may be occasionally necessary to reopen the wound made in the first instance every twenty-four hours for two or three days. This may be readily done with a small, grooved director.

An ulcer, again, may be upon the point of perforating the cornea, when paracentesis is called for to prevent prolapse of the iris. In that event, the puncture is best made through the floor of the ulcer, instead of through the margin of the cornea. The needle is passed almost vertically through the bulging base of the ulcer, and its direction is then altered so that it lies against the posterior surface of the cornea during the rest of the thrust. The aqueous is slowly evacuated during the withdrawal of the instrument.

A last indication for paracentesis is furnished by the presence of

pus in the anterior chamber, which refuses to yield to ordinary treatment. The matter in these cases is often very tenacious, and it may be necessary to withdraw it by the aid of a pair of iris forceps.

As we have already seen, the treatment both of pannus and of corneal ulcers is closely bound up with that of trachoma. Slight cases will improve *pari passu* under the ordinary escharotic methods used for the latter condition. Special attention is called for only when pannus is accompanied with marked vascularity or by severe subjective symptoms. Under these circumstances, the plan described when speaking of relapses should be adopted. With regard to the employment of strong agents during the existence of an inflamed pannus, my experience is that it is quite safe to apply a two per cent. solution of lunar caustic to the lids daily. After all, the corneal mischief is secondary, so that it is not altogether surprising that the ordinary treatment of the primary trachoma should benefit the pannus.

It is important to note, however, that attending to the state of the lids has certain clearly-defined limits. Active symptoms may be speedily subdued, and the density of a pannus materially lessened; and so long as any vessels can be recognised, either with the naked eye or by the aid of a lens, improvement may be confidently expected to follow the use of escharotics. But in anything like a severe case, it is quite the exception for complete recovery to occur; and a close examination years after the trachoma has run its course will reveal the existence of areas of opacity, more especially in the upper half of the cornea. The explanation is, that the cellular exudation has penetrated through Bowman's membrane, and has organised into cicatricial tissue incapable of absorption, at least under the ordinary methods of treatment. This connective tissue change may often be recognised by focal illumination, inasmuch as the parts affected possess the glistening whitish-grey appearance suggestive of scars in other parts of the body. Indeed, further metamorphoses are occasionally observed. For example, a few dots of chalky white colour may be seen scattered here and there through the tissue of the

pannus. As a great rarity, I have also noticed one or more small black masses intermingled with the corneal opacity. It is probable that such pigmented dots are derived from the colouring matter of blood that has escaped at some former time from the vessels of an active pannus.

When vessels are few and the cornea practically covered with opacities, we must resort then to other methods of treatment. Massage, in combination with one or other of the mercurial ointments, is a simple and effectual plan of treating *pannus siccus*, as the condition is termed. The unguents commonly used are the yellow oxide (1 to 4 per cent.), and ammoniated mercury (1 to 4 per cent.); but more good may sometimes be effected by the *Unguentum Hydrargyri* of the British Pharmacopœa: A small portion of one of these ointments is placed in the conjunctival sac, and the closed lids are then rubbed firmly but gently for some minutes, in fact until the eye gets red and tender. This process is repeated two or three times in the course of the twenty-four hours, and its measure of success will not infrequently depend on the skill with which the rubbing is carried out. Mr. M'Gillivray,²²⁴ of Aberdeen, has recently proposed to use an ointment every two hours, instead of three times a day, as is customary. He recommends the following formula: Hydr. oxid. flav., gr. 2, atropine gr. 1, cocaine gr. 3, lanoline and water 2 drachms. I have tried this plan upon a limited scale, but have not yet been able to arrive at a definite conclusion as to its value. An application twice daily of calomel now and then succeeds where the ointments fail. A further means of encouraging reaction is to foment the lids with hot water for ten minutes or so four or five times during the day.

The combined treatment is tedious, and requires great perseverance on the part both of patient and of surgeon. It may have to be continued for many months before definite results are obtained, and, indeed, in some instances it does no good whatever. Still it is simple, and should be tried in every suitable case.

Another plan of treating pannus siccus is by the employment of

jequirity. There are many modes of using that agent, but the simplest, perhaps, is to apply a 5 per cent. infusion. The seeds may be obtained ready ground from a chemist, and five grammes (about 75 grains) are mixed with 100 cubic centimetres (about $3\frac{1}{2}$ ounces) of distilled water. The mixture is well shaken and allowed to stand for an hour, when it will be ready for use. It is not strained, but decanted as required without disturbing the sediment.

The everted conjunctiva is brushed with the liquid one to three times a day, and the applications continued for a period that will vary according to the result desired. The 5 per cent. solution is an active one, and a single application will in some patients give rise to a smart jequirity-ophthalmia. Usually, however, six to ten brushings are needed to set up active inflammation, which will be marked by œdema of the upper lid, some chemosis, enlargement of the pannus vessels, along with the production of a greyish or buff coloured membrane on conjunctiva or even on cornea.

It is safe to inoculate a single eye with jequirity, inasmuch as the inflammation set up by that agent is not communicable.

Jequirity is contra-indicated when trachoma is still active ; that is to say, when the palpebral conjunctiva is congested, succulent, granular, and secreting muco-pus. The presence of ulceration of the cornea, again, constitutes an absolute bar to its employment. Serious consequences have followed the application of jequirity under such circumstances. The agent has been specially recommended when the conjunctiva is much scarred, and the cornea covered either partially or wholly by a non-vascular pannus.

My experience with jequirity has not been on a large scale; indeed, as a matter of fact, I have employed the agent twenty-nine times only. With four exceptions, the cases selected were examples of pannus siccus, in which the morbid processes of trachoma had been subdued. A certain amount of constitutional disturbance often accompanied the ophthalmia, although the temperature seldom rose beyond 100° F. In almost every case the applications caused considerable pain, together with swelling and tenderness of the pre-auricular and cervical glands. Ulceration of the cornea did not occur, but on three occasions

a suppurative inflammation of the tear-sac called for independent treatment. The pupil was always contracted, and much photophobia was present. In some cases small haemorrhages were noted in the substance of the cornea, the result of rupture of the dilated pannus vessels. As to pannus, in no instance was any definite improvement effected; as soon as the inflammation set up by the drug had passed away, the cornea reverted to its original condition. In my experience, therefore, the treatment has proved disappointing.

A word may next be said concerning a peculiar condition in which a thick and vascular pannus is associated with a cured trachoma. These cases must be rare, for I have not encountered more than half-a-dozen during a somewhat extensive experience of the disease. To apply escharotics to the conjunctiva would, under the circumstances, be as irrational as it would be unscientific. The proper plan, of course, is to treat the cornea itself—a process that is best carried out by the daily application of the copper stick. Another method is to cover the pannus with a thin layer of the precipitated bluestone, and to renew the application daily. Should the condition not yield to either of those plans, then recourse must be had to the operation of peritomy.

Peritomy consists in removing a strip of conjunctiva and subconjunctival tissue from immediately around the cornea. It is a simple operation, and may be performed under cocaine. The patient is recumbent, and the lids are kept open by a stop-speculum. A circular incision, some 3 mm. or 4 mm. from the sclero-corneal junction, is made through the conjunctiva by means of blunt-pointed scissors. The resulting zone of tissue is then dissected up to the margin of the cornea, and removed as close to that structure as possible. The next step is to scrape away the exposed subconjunctival tissue with a small Volkmann's scoop, so as to leave the sclera bare and clean. No sutures are required. A pad and bandage will complete the dressing.

Peritomy was formerly employed by me in active pannus, or in pannus that did not readily respond to the customary escharotic treatment, but the results obtained were by no means satisfactory.

I next tried partial peritomy,—*i.e.*, removal of a strip of tissue at a point opposite to the pannus—but with no great measure of success. At the present time I perform the operation only when a vascular and active pannus is associated with a cured, or nearly cured, trachoma.

I have had no experience of a plan lately recommended by Dr. Gruening²²⁵—viz., that of scraping away a pannus with a sharp scalpel. The method, however, would probably be useful in the cases we have just discussed.

It is impossible to leave this subject without making some allusion to what the French term *le traumatisme chirurgical oculaire*. By that expression is meant the influence believed to be exerted upon pannus by any operation carried out either upon the eye or upon its surroundings. For example, at the Lariboisière Hospital, Panas had a patient with trachoma and pannus, who was affected at the same time with a convergent squint. The latter condition was operated upon, and from that moment the cornea began to clear, while the granulations disappeared by degrees.²²⁶ After iridectomy, sclerotomy, and canthoplasty, the same sort of thing has been observed. Hence, by the performance of some such operation, French surgeons endeavour to evoke this mysterious influence.

It appears to me that the results obtained may be explained on the ground of mere coincidence. It is well known that pannus and trachoma do now and then manifest a tendency to spontaneous cure. I remember a case in which I had tried many remedies, but without avail. The patient—an unruly girl, about fourteen years of age—was at length removed to another part of the institution, and placed under the charge of a woman who, although a strict disciplinarian, had no pretensions whatever to skill in nursing. To my surprise, the remedies that formerly failed to do any good now acted admirably, and in a short time the patient was cured. Again, I have seen obstinate cases improve markedly after a zymotic, as, for instance, scarlet fever or whooping cough. Koltchewski²²⁷ has related the history of a soldier with trachoma, a malady that under-

went spontaneous cure after an attack of facial erysipelas. These instances seem to me to be parallel with those in which improvement has been observed after operation.

On first coming under notice, a small percentage of trachoma cases are found to have leucoma adherens, which is equal to saying that the cornea has suffered perforation on some former occasion. This result must be rare, inasmuch as I have never witnessed it personally. Neither have I observed staphyloma, partial or complete, of the cornea.

Apart from actual staphyloma, a cornea whose tissues have been invaded by widespread pannus is likely to have its curvature considerably modified (*Keratectasia ex Panno*). In this way, irregular astigmatism is produced, and myopia becomes relatively common. Both conditions may be often relieved to some extent by suitable glasses. It is always worth while, therefore, to examine such cases, in order to ascertain what may be done by optical help. Lastly, the fact may be added that there are rare instances where sight may be improved by iridectomy. That operation, however, ought never to be undertaken unless (1) other means have failed to improve the condition of the cornea ; (2) the trachoma has been cured ; (3) sight is found to be better after than before dilatation of the pupil ; (4) squint is absent ; and (5) good perception and projection of light are present.

In conclusion let me state that, in my experience, blisters are rarely needed in pannus, and that I never employ a seton nowadays. The latter agent appears to me to be perfectly useless. As a general rule, the patients should take plenty of out-door exercise, and the use of a darkened room can seldom be necessary. If intolerance to light be a marked feature of the case, glare may be minimised by a shade or by smoke-coloured protective goggles.

DERMATITIS.

It is by no means rare for the delicate skin at the outer canthus to become inflamed as the result of soddening by tears and other secretions. The dermatitis thus brought about often goes on to the

formation of an actual crack or excoriation, extending through the skin into the subcutaneous tissue. The little fissure readily bleeds, and may give rise to exquisite pain, more particularly in nervous subjects. As to treatment, it may be lightly touched with the nitrate of silver crayon, although its tendency is to get well of its own accord as the eye symptoms subside.

ABSCESS.

Another small complication of trachoma may receive passing mention, namely, a collection of pus in a Meibomian gland. Such an abscess is common, and generally affects the upper lid. Its presence is shown by a yellowish spot on the tarsal conjunctiva, and, if of some size, by an obvious swelling in the substance of the lid. It arises suddenly, and causes a certain amount of pain. Treatment is simple: a knife is passed through the conjunctiva into the abscess, and its contents evacuated. This localised collection of pus should not be confounded with the cavities described by Iwanoff and by Berlin in the later stages of trachoma, and regarded by them as glands of new formation. When visible to the unaided eye (as they sometimes are), these take the form of small yellowish bodies, which remain unaltered for an indefinite time. Another point of distinction lies in the fact that they are painless.

BLEPHARITIS.

Blepharitis, although not strictly speaking a complication of trachoma, is so often met with in cases of that disease as to demand careful consideration.

The first step in every case is to remove scabs, scales, or crusts by the application of hot water, to which a small quantity of borax or carbonate of soda has been previously added. A good prescription for the purpose contains 10 grains of the chloride of sodium, with 20 grains of the baborate salt, to 1 ounce of distilled water. A 10 per cent. solution of chloride of ammonium has been praised by my colleague, Dr. Litteljohn, who has had much experience of the disorder. Chloral hydrate (5 per cent.) acts sometimes even better than any of the alkaline solutions, although it has the disadvantage of

causing some slight pain. It was, I believe, first recommended by Dr. Gradle.

The raw surface is next to be rubbed, not merely smeared, with an ointment containing one or other of the following drugs, named in their order of merit:—Hydr. oxid. flav. (grs. 8-24); hydr. ammon. (grs. 8-24); hydr. oxid. rub. (grs. 8-24). These various salts seem to act better if lanoline (*Adeps lanæ hydrosus*, P.B.) be used as the excipient rather than vaseline. With many surgeons, a favourite remedy is the dilute citrine ointment, which combines 1 part of the *Ung. hydr. nitr.* (P.B.), with 6, 7, or 8 parts of vaseline.

The foregoing plan, continued for a few weeks, will suffice for the cure of mild cases; but other measures will be needed when the roots of the lashes have become the seats of ulcers or of pustules. Removal of the cilia is an old-fashioned but effectual remedy, and so, too, is the daily application of the silver stick, pure or mitigated. Tincture of iodine or oil of cade often succeeds admirably, and should be pencilled over the edges of the lids once or twice in the twenty-four hours. Instead of those remedies, one may use a solution of corrosive sublimate in glycerine (1 in 100).

As the result of chronic blepharitis, the edge of the lid occasionally becomes thickened and almost callous, a state of things formerly known as *tylosis*. The best treatment, in my experience, is to make at intervals of a few days a number of small punctures into the intermarginal space, and then to encourage bleeding by hot fomentations. Further, the thickened parts should be anointed with one of the above-mentioned mercurial preparations. I have found sulphurated lime given internally a useful remedy; $\frac{1}{4}$ to $\frac{1}{2}$ gr. may be administered in pill form three to six times a day.

In old and neglected blepharitis, the lashes will be scanty and irregular, and small scars near the free margin of the lid may by traction give rise to trichiasis. The punctum lacrymale may be displaced, so that the tears are constantly overflowing on to the cheek, and the lid-border may be separated from the globe by a shallow groove. Scales, scabs, and ulcerations are not usually present, but the Meibomian glands are obliterated, and the lids are disfigured by

an unsightly red margin, liable at any moment to become acutely inflamed by exposure to dust, wind, or other irritating agencies. Under these circumstances, benefit may be sometimes obtained by covering the lids at night with a strip of linen smeared with Janin's ointment, compounded according to the original formula:—Prepared tutty and Armenial bole, of each 2 drachms; ammoniated mercury, 1 drachm; lard, $\frac{1}{2}$ ounce. Another good application is ung. zinci oleat, 2 parts; ung. acidi borici, 2 parts; and ung. diachyli, 1 part. If the punctum be not in its proper position, and if persistent lacrymation be present, then the inferior canaliculus should be slit up in a way that will be described later. Lastly, every effort should be made to improve the nutrition of the patient by good and sufficient food, as well as by the administration of cod-liver oil, quinine, or chalybeates.

The surgeon should be always on the look-out for two conditions, each of which is capable of giving rise to a kind of spurious, or rather secondary, blepharitis.

The first is an abnormal shortness of the upper lid, originally described by Fuchs.²²⁸ The defect is congenital, and not at all uncommon. It may affect one or both eyes, although in the latter case it is often unequal on the two sides. The pathognomonic sign of its existence is that when the patient is directed to close his eyes gently, the edges of the lids do not come into complete apposition. Those who are the subjects of the defect habitually sleep with eyes more or less open; and a rough idea as to its extent may be gathered from the amount of conjunctiva then exposed to view.

The second condition that may cause blepharitis is disorder of the tear-conducting apparatus. Thus, obstruction in any part of the lacrymal passages may set up a troublesome form of the disease that can be subdued only by the removal of its exciting cause. It may be well to recall the fact that cases of this kind are generally unilateral.

It seems scarcely necessary to point out that a superficial resemblance to blepharitis may be produced by the presence of the eggs of the *pediculi pubis* on the cilia. The nits, generally of dark colour, lie close to the roots of the lashes, and may be present in

great numbers. Mixed with them, one often sees minute reddish dots of excrement, and, on searching closely, it is usual to discover one or more lice. The affection is fairly common among the children of the poor, but, personally, I have never seen it in an adult. It may be readily cured by the application of a mercurial ointment, the lashes having been previously clipped close.

Before leaving the subject, the relation of errors of refraction to blepharitis may be briefly touched upon. The theory that a close connection exists between the two conditions was advanced by Roosa²²⁹ in the year 1876, and a similar statement has been made recently by Mr. Ernest Clarke,²³⁰ who based his conclusions upon the examination of 100 cases of tinea tarsi. Mr. Clarke claims that blepharitis "is an expression of asthenopia, the result of ametropia, which was invariably present."

One cannot deny that, in patients with delicate skin, the continual strain resulting from certain uncorrected refractive errors (hypermetropia and astigmatism) may give rise to some redness of the edge of the lid. It is unlikely, however, that ametropia would lead either to a formation of scales or to an actual ulceration of tissue, conditions that are probably due to specific micro-organisms. It seems likely that under the common name "blepharitis" at least two classes are included—first, cases marked by mere hyperæmia, which may remain unchanged throughout life; and, second, those characterised by true inflammation and its consequences. The known facts all appear to indicate that the latter are of parasitic origin. Thus, the disease often starts in a particular group of hair follicles, and later spreads along and invades the neighbouring follicles; Widmark and Cuénod²³¹ have independently demonstrated the *staphylococcus albus* and *aureus* in the affection; lastly, the most effectual remedies are germicides. The well established clinical fact that the malady is specially prone to attack strumous subjects may be explained by assuming that the soil is favourable to the growth of parasitic organisms.

Before we admit a causal connection between errors of refraction and blepharitis, it will be necessary to show—(a) that ametropia is

relatively more common amongst those with tinea tarsi than in other persons of similar age, sex, and social standing; (*b*) that the blepharitis may be cured by correction of refractive error, without recourse to other measures*; and (*c*) that a permanent cure of the lid-affection can be obtained in no other way than by the provision of suitable spectacles.

PHOTOPHOBIA.

The dread of light that now and then complicates trachoma may be so marked as to call for separate treatment. The symptom, however, is not common unless pannus or ulcers of the cornea be also present; and, as a general rule, it improves step by step with those conditions.

As to special treatment, photophobia may be sometimes relieved by a series of blisters—not exceeding a threepenny bit in size—applied behind the ears, and persevered in for some weeks. Another excellent plan was introduced many years ago by Wormald and Hocken²³² as a cure for “strumous ophthalmia,” and consists in pencilling the skin of the eyelids with a slightly moistened crayon of pure lunar caustic. It is seldom necessary to repeat the application more than twice. I have at times succeeded in getting rid of obstinate photophobia by rubbing into the brow and temple Sir Thomas Watson’s unguent, which combines two grains of powdered opium with ten grains of the strong mercurial ointment. A more cleanly and equally efficacious medicament is made of the mixed oleates of mercury (10 parts), of atropine (2 parts), and of aconitine (1 part). As regards the eye itself, one of the best applications with which I am acquainted is the following:—Hydr. oxid. flav. and atropine, of each 2 grains; vaseline, 4 drachms: a morsel to be placed in the conjunctival sac once or twice daily. It should be carefully noted that cocaine, as a rule, does more harm than good, while atropine is decidedly indicated. Cold baths—shower, needle,

* On second thoughts, the foregoing statement requires some slight modification, inasmuch as a hyperæmia being once started, may be kept up by secondary causes, *e.g.*, the invasion of micro-parasites.

or plunge—often do good, while quinine internally seems to possess an action that is almost specific in some of these cases. Finally, the old plan of immersing the face in cold water once or twice daily, has now and then rendered me service.

PTOSIS.

Although ptosis is one of the most frequent complications of trachoma, there is still much difference of opinion with regard to its etiology. When it makes its appearance early in the disease (that is, during the period of granulation development), it is probably due to infiltration of the muscle of Müller and the levator palpebrae superioris by the characteristic lymphoid cells of trachoma. In the hypertrophic stage of the malady, the lid droops, partly because its tissues are heavier, and partly because the muscles have been weakened by invasion with pathological products. During the cicatricial phase of trachoma, ptosis is perpetuated by the more or less complete obliteration of the upper fornix, a condition that places the levator at a mechanical disadvantage.

In unilateral cases the movements of the affected side are good; that is, they accompany the lid of the sound eye in all its excursions, but start, as it were, from a wrong position. In other words, the ptosis is concomitant, and to that extent resembles an ordinary convergent squint. It is both curious and interesting to observe that trachomatous ptosis, in one and the same patient, may vary in amount from time to time.

A spurious form of ptosis, at times associated with active pannus, may be mentioned briefly. In this particular case the patient allows the upper lid to fall voluntarily, so as to protect the inflamed surface, but as the corneal condition improves, the drooping gradually disappears.

To correct the ptosis, some authors—for example, Meyer²³³—have recommended systematic exercise of the levator muscle. They make the patient look upwards for a few moments, and repeat the act several times a day. The practice has never rendered

me any service, and to my mind it seems a mere waste of time to employ it.

On the other hand, it must be seldom that ptosis calls for operative interference, unless one eye be chiefly or exclusively affected. In that case the deformity is often conspicuous, and a difference of 2 mm. and 3 mm. between the level of the upper lids may cause the patient much annoyance. It may be added that no operation ought to be undertaken unless the trachoma has run its course.

My first attempts to remedy the deformity were made by removing an elliptical piece of skin from the surface of the upper lid and inserting sutures—an operation that did no good at all. Next I tried Graefe's method of taking away, not only skin, but a strip of orbicularis muscle as well. The results, however, were again disappointing.

I then turned my attention to other methods, based, as it seemed to me, upon a more rational principle, namely, that of shortening, or "advancing," as it is termed, the tendon of the levator palpebræ. Snellen's thread operation was selected, a procedure that may be described in the author's own words:—"One end of a double-armed thread," he wrote, "is passed through the whole thickness of the lid just at the upper border of the tarsus. The eyelid is then turned inside out, and the other end of the thread is passed through its whole thickness, piercing the conjunctiva and tendon of the levator as high up as possible, and brought out through the skin at a point near that of entry of the other end of the thread; both ends of the thread are provided with a bead and tied. On both sides of this first suture two others are applied in the same way, well observing that the levator palpebrae has a direction inwards towards the mesial line."²³⁴

With the trivial exception that beads were dispensed with, this simple operation was performed in the way described by Snellen. General anæsthesia was not resorted to, because it was found that the manipulations were practically painless, as long as a few minimis of cocaine solution had been previously injected beneath the skin of the lid.

As soon as the sutures are tied, the tissues above the tarsus, including, of course, the levator muscle, become, so to speak, puckered, and form a horizontal fold of considerable size, that remains visible for many months, perhaps permanently. The operation is followed by oedema of the lids, a condition that subsides, however, after removal of the threads. A common complication was a kind of tarsal abscess, doubtless of septic origin, which, after causing redness, pain, and swelling, discharged its contents through one of the suture tracks.

In none of my cases did I attempt to remove the sutures until a fortnight after operation, and the central thread was usually left in place for a longer period.

The immediate result of Snellen's operation, in my hands, has not been satisfactory. Some months after its performance, however, improvement took place in a certain number of instances. This method of advancement, nevertheless, leaves something to be desired, so that I have lately practised a simple modification, which may thus be described. Local anaesthesia is secured by injection of cocaine, and a semi-elliptical incision is made through the skin of the lid immediately above the upper edge of the tarsus. For this latter purpose ordinary strabismus scissors will be found the most convenient instrument, the skin having been previously punctured with a sharp knife. The fibres of the orbicularis muscle are then separated, so as to expose the palpebral fascia and the upper border of the tarsus, to which the levator is attached. The next step is to pass three or four fine chromicised catgut threads in and out of the tendon, and then to draw them together and tie them in knots. In this way the tendon is shortened in exact accordance with the space included within the stitches. The ends of the original semi-elliptical incision are then joined by a similar cut, and the fold of skin thus marked out removed. The operation is completed by bringing together the edges of the wound by a sufficient number of interrupted silk or horse hair sutures.

The external wound heals by first intention, while the catgut sutures, after shortening the levator, become absorbed.

The results of the operation are often gratifying, and, upon the whole, I prefer it to any other that I have tried.

AFFECTIONS OF THE TEAR PASSAGES.

Affections of the tear passages are now and then observed, although, so far as my experience goes, only in the later stages of trachoma.

The usual condition is to find one or both of the puncta occluded, so that the eye is perpetually watering. Under such circumstances, it will be proper to perform a small operation. An attempt must be made to reopen the passage by passing a pointed knife into the tissues of the lower lid as near as possible to the spot that would be occupied by the punctum under normal conditions. Weber's beaked knife is next passed through the opening, pushed along the track of the canal into the tear sac, and made to cut its way out in such a manner that an open trench is formed leading from conjunctiva to sac. To make this incision correctly is a matter of considerable importance: if the blade be made to cut directly upwards, the resulting slit will not carry away the tears properly. Care must be taken, therefore, to cut somewhat backwards—*i.e.*, towards the globe—in order that the trench may open in that direction.

The lips of the cut canaliculus often show a tendency to adhere to one another, a state of affairs that may be met by either of the following plans. The first is to pass a small probe or other suitable instrument along the track of the wound daily for some little time after operation. Any adhesions that may form are in this way broken down. The second plan was introduced by the late Mr. Haynes Walton, and consists in snipping away a small piece of the posterior lip of the trench made at the first operation.

Considerable difficulty may be experienced in opening the canaliculus. The fact may be easily explained: it has been shown by Moauro and others that the small-celled infiltration of trachoma is liable to attack the mucous lining of the canaliculus, which it constricts or obliterates in the course of its further change into scar-tissue. Under such circumstances, a persevering attempt should be

made to pass Weber's knife, and if it be not successful on the first occasion, it may be repeated a day or two later. In another plan, an oblique cut with scissors is made across the track of the canal, and it may then be possible to push a fine probe into the nasal sac.

As soon as the latter structure is opened, it is not uncommon for a quantity of thick, glutinous material—at times containing cholesterin crystals—to escape from the incision. This indicates that the nasal duct is occluded; that we have to deal, in fact, with an "encysted mucocele." In such a case, we may in the first instance endeavour to overcome the obstruction by injecting a tepid solution of boric acid with a Lüer's syringe. That failing, the next step will be to dilate the stricture mechanically by passing Bowman's probes. It is unnecessary, however, to enter farther into the particulars of this operation, which will be found fully described in all the text-books of ophthalmology.

INFLAMMATION OF THE IRIS.

Iritis is mentioned in the text-books as a complication of trachoma, but I have never seen it occur apart from pannus or ulceration of the cornea. Even under those circumstances, it is rare, although mere hyperæmia is common enough. In such cases, it will be advisable to dilate the pupil by the use of atropine, either in solution or in ointment form. Beyond that, nothing need be done, except, of course, to keep up the treatment of the primary condition.

TRICHIASIS AND ENTROPION.

Trichiasis and entropion are not often met with in patients under seventeen years of age, and are sequelæ rather than complications of trachoma. They may occur, indeed, many years after the disease has come to an end. The two conditions may be considered together, because (1) they are sometimes associated in the same individual; (2) the mechanism of their production is similar; and (3) their treatment is practically identical.

There is a peculiar condition, distichiasis, in which a more or less posterior row of lashes is directed towards the eyeball, whereas

an anterior row is placed normally. Since both affections are often seen in one person, it would seem as though distichiasis were merely an early stage of trichiasis, the rows of lashes having been dragged apart by cicatricial contraction of the conjunctiva. The surgeon should carefully distinguish this from a rare congenital condition, in which a misplaced row of cilia is present. Treatment is the same as that adopted for the acquired form.

Trichiasis generally affects the upper lid. It may be partial or complete ; that is to say, some or all of the lashes may be misdirected. Perhaps the commonest state of things is for a bundle of lashes, derived from the outer $\frac{1}{3}$ or $\frac{1}{2}$ of the intermarginal space, to turn in upon and irritate the eye. In most instances when trichiasis attacks the lower lid, it results rather from the traction of scars following severe blepharitis than from trachoma, pure and simple.

The ill-directed lashes may be strong and well formed. But more usually they become, wholly or in part, so slender, stunted, pale, and downy as to be recognised with difficulty, although they cause none the less irritation on that account.

Entropion is much rarer than trichiasis, and, like that affection, may be either partial or complete. The two conditions may be readily distinguished by noticing the position of the intermarginal space, a structure that is more or less bent inwards towards the eyeball in entropion, whereas in trichiasis it keeps its natural position.

Trichiasis and entropion give rise to a similar train of secondary symptoms. The cornea—probably already damaged by pannus—is exposed to constant mechanical irritation, caused by cilia in the first, and by skin and cilia in the second affection. Consequently, recurrent inflammations of traumatic origin are commonly met with, and the cornea becomes more and more opaque and vascular. At the same time, various degrees of irritation and pain are complained of ; photophobia is present ; the eye is reddened at points that correspond to the offending lashes ; and patients will often indicate the exact spots where the misdirected cilia lie.

The symptoms of entropion are naturally more severe than those of mere trichiasis.

Trichiasis and entropion occur only when the conjunctiva has undergone extensive cicatricial changes. The mechanism of their production may be explained thus. In severe trachoma, the tarsus of the upper lid becomes infiltrated with small cells, and hence its whole structure becomes softer than normal. Meanwhile, the palpebral conjunctiva is cicatrising and shortening, and the "cartilage" is bent in obedience to the traction exercised upon it by its firmly attached lining membrane. Hence the upper lid—being moulded, as it were, upon the tarsus—becomes distorted, a condition readily appreciable to touch, and often to sight. Now, if the conjunctiva contracts in the transverse direction, the tarsus, and consequently the lid, will be thrown into one or more vertical furrows. Should the conjunctiva, however, shorten in the vertical direction, then the tarsus will show a blunt, angular bend, some three millimetres above the free edge of the lid. In the latter event, the intermarginal space carrying the cilia will be twisted in towards the eyeball, or, in other words, entropion will be present. By the subsequent cicatricial contraction of the tarsus, the deformity will be perpetuated, or even increased. On the other hand, when the changes are conjunctival rather than tarsal, the lashes will be pulled out of their natural line, and distichiasis or trichiasis will result.

Before leaving the subject, it should perhaps be noted that, in Raehlmann's opinion, some at least of the false cilia of trichiasis are of new formation. He believes that they arise, not only as buds from existing follicles, but also from the epithelium of the intermarginal space, the impetus to their formation being a blepharitis, due in the first instance to trachoma.

The earliest sign of traction by the conjunctiva is furnished by the orifices of the Meibomian glands, which lose their circular outline, and become first oval, and later slit-like. The posterior edge of the intermarginal space then becomes indented at one or more points, and the lid acquires a characteristic "nibbled away" appearance. After continued traction, many of the Meibomian openings are altogether obliterated, while the posterior marginal border is rounded off in its whole length. At the same time, the

lashes are distorted, and the familiar picture of a more or less complete trichiasis will be produced. When it is added that different segments both of conjunctiva and of tarsus may be implicated to an unequal extent by cicatricial changes, it will be easy to understand why trichiasis and entropion are so frequently found side by side in one and the same eye.

The simplest treatment of trichiasis consists in pulling out the offending lashes, an operation that may be undertaken at any stage of the disorder. For this purpose, the most convenient instrument is a pair of epilation forceps, with broad rounded ends and no teeth (Fig. 6). The surgeon stands behind the patient, who should be seated facing a good light. If the whole row of lashes be affected, the lid is lightly stretched between the fingers, and the bundles of lashes rapidly plucked out, those that have escaped the grasp of the forceps in the first instance being carefully searched for and

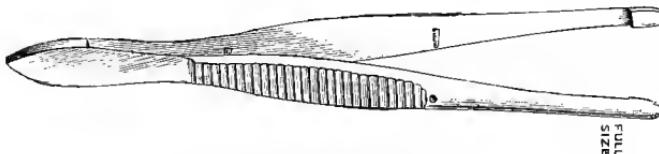


FIG. 6.—Epilation forceps.

picked off afterwards. In removing a few cilia, each one should be seized as close to its root as possible. The surgeon then pulls the lash steadily forwards until, torn from its follicle, it comes away in the grip of the forceps. In order to distinguish the finer hairs, it is often necessary to move the lids in various directions, or even to use focal illumination and the magnifying glass. It is of practical importance to recollect that the patient is generally able to indicate the position of lashes overlooked by the operator. It is an old-fashioned plan to apply lunar caustic to the edge of the lid after epilation, the idea being that the agent hinders renewed growth of the cilia.*

* According to Guthrie,²³⁵ the practice of destroying the misdirected lashes by chemical means was known to the ancients. Antonius Musa, for example, used a paste composed of alum and vitriol; Paulus Aegineta, a caustic of quicklime and soap. In more recent times, Heister proposed potassa fusa, while Duval employed the hydrated sulphide of calcium. One need hardly remark that these depilatory methods are now wholly abandoned.

Unfortunately, however, epilation has to be repeated at intervals of a week or so, inasmuch as renewed growth takes place. The removal of the lashes, moreover, becomes increasingly difficult. In most cases, therefore, this palliative method has to yield sooner or later to more radical means, of which a great variety—depending upon the most diverse principles—have been devised.

If a few cilia only be turned in, it will be good practice to destroy the hair-follicles by electrolysis. In the absence of a special instrument, an ordinary sewing needle, attached to the negative pole of a galvanic battery, is plunged into the lid, as close as possible to the

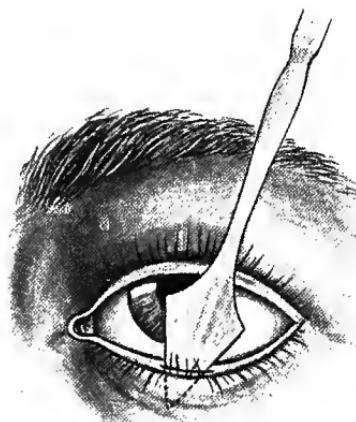


FIG. 7.—The "Excision" operation for trichiasis.

misplaced lash. A moistened sponge, connected with the positive pole of the battery, is next brought into contact with the patient's face, or is grasped by him. After a few seconds, some minute bubbles will be seen around the needle, which may be then withdrawn from the lid. The last step is to remove the lash by means of forceps, a process sufficiently easy to accomplish, provided the operation has been properly performed.

Another plan that has rendered me good service consists in excising the affected parts. It is admissible only when a limited number of lashes are involved, but has the great advantage of being

equally applicable to any part of the lid. It is thus performed:—A straight keratome (or other suitable instrument) is thrust deeply into the intermarginal space, so as to pass behind the misplaced cilia, but in front of the tarsus. In this way, an incision is made along the centre of the intermarginal space corresponding in length with the irregular lashes (Fig. 7). A triangular flap is then excised from the skin of the eyelids, the base being formed by the first incision. When removed, this flap carries bodily with it the offending lashes, and the resulting gap is closed either with a fine harelip pin or else by a point or two of interrupted suture.

If many hairs be involved (or if entropion be present), recourse

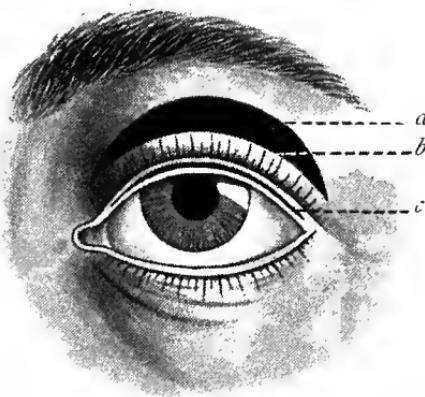


FIG. 8.—Jaesche-Arlt operation. *a*, Intermarginal incision; *b*, position of second incision; *c*, position of third incision.

must be had to other methods. Surgical interference, however, should never be undertaken unless the cicatricial processes have come to a standstill, or, in other words, until trachoma has been cured. The most carefully planned and skilfully executed operation will be rendered well nigh useless if this precaution be neglected, as relapse is almost certain to take place later.

There are three radical methods for the cure of trichiasis that may be briefly described, the operations, namely, that bear the names of Jaesche-Arlt, Van Millingen, and Spencer Watson, respectively. I have had good results with all of them, but now reserve the first two for complete, and the last for incomplete trichiasis.

If cocaine be injected under the skin of the lid, the operations may be performed without general anaesthesia.

The first step in the Jaesche-Arlt operation (Fig. 8) is to split the free edge of the lid into two layers by means of an incision, 3 mm. or so in depth, in the intermarginal space (*a*). One part is anterior, and contains skin, orbicularis muscle, and lashes, together with their follicles; the other part is posterior, and includes tarsus, Meibomian glands, and conjunctiva. To make the intermarginal incision correctly is a matter of importance, although it is by no means always easy to do when the border of the lid is thinned and distorted by

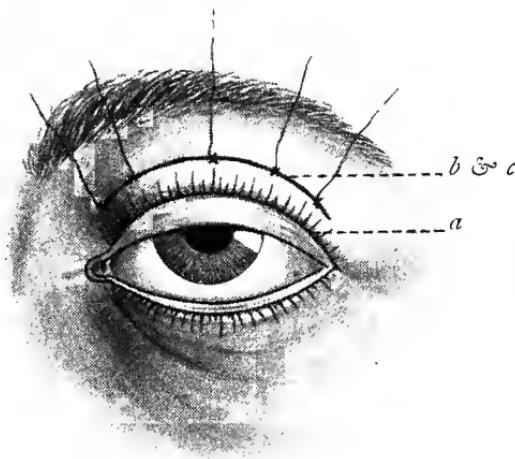


FIG. 9.—Jaesche-Arlt operation.
(Lettering corresponds with that of Fig. 8.)

long-standing disease: a thin sharp blade should be thrust into one or other end of the leaden-coloured line that intersects the free margin of the lid, and made to cut its way along the entire extent of that structure, excluding, of course, the punctum lacrymale. A second incision (*b*) is then made running through the skin parallel to the free edge of the lid, and passing down to the tarsus, so as to join the intermarginal section. At this stage of the operation the condition of the parts may be likened to a sort of bridge bearing the lashes, and consisting of skin and orbicularis muscle, free at its upper and lower sides, but attached at either end. The two

extremities of the second incision are now joined by a curved cut (*c*), so that a semi-elliptical piece of skin is included between the two incisions. The flap thus marked out is then removed by dissection, but without including the fibres of the orbicularis muscle. Its size will be regulated by the laxity of the skin and by the amount of traction required, and may be roughly gauged by grasping the integument with forceps after the intermarginal section has been made. The last step is to unite by points of interrupted suture the edges of the wound left by removal of the skin flap (Fig. 9). The result of the Jaesche-Arlt operation will be that the cilia-bearing flap, freed from its attachments by the primary incision, will be shifted upwards, *i.e.*, away from the edge of the lid. Many surgeons, myself among

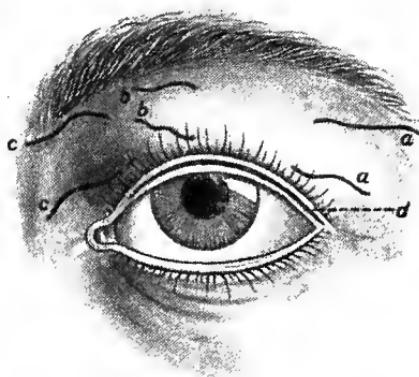


FIG. 10.—Van Millingen's operation. When the sutures (*a*, *a*; *b*, *b*; *c*, *c*) are tied, the intermarginal incisor (*d*) will gape widely.

the number, utilise the excised skin to cover the raw surface of the exposed tarsus, thus hoping to prevent subsequent cicatricial contraction.

After dividing the free edge of the lid into two parts, as in the foregoing operation, Van Millingen³⁹ secures a wide separation between the cut surfaces by inserting three stout silk sutures into the skin of the lid, at some distance from the wound (Fig. 10). Into the gap thereby made he next transplants a piece of mucous membrane, taken either from the patient's lip or from that of a rabbit. The graft becomes attached in twenty-four hours or so, when the sutures are to be removed from the skin of the lid. It is

not fastened in any way to the lips of the intermarginal incision, but merely pressed into place by a pledge of sterilised wool.

Under the name of the "St. Mark's Hospital Operation," Arthur Benson²³⁶ has introduced a slight modification of Van Millingen's original procedure. He splits the affected lid along the whole length of its free border, making his incision obliquely through the tarsus and into the subcutaneous tissue. He next divides with a pair of fine scissors any remnants of the tarsus that may have escaped in the first instance. He then clamps the lip (upper or lower), everts that structure, and removes a worm-like piece of the mucous membrane by two parallel cuts which converge towards their ends. The flap thus obtained is cleared of fat, and fastened into the intermarginal incision in the following way:—"A fine waxed silk suture is passed through, close to its pointed extremity, from mucous to raw surface; the needle is then passed through the lid at the angle of the incision, from raw surface to lid border, and tied into position. By making a large knot on the suture a few inches from its end, the point of the flap can be drawn closely into the angle of the incision, and kept in close apposition with it. Another similar suture is applied to the other end, and two, three, or four sutures are used to keep the edges of the flap in close apposition with the lips of the lid wound." The stitches, it may be added, are removed three or four days after the operation. It will be seen that the "St. Mark's Hospital Operation" differs from Van Millingen's in three particulars:—1st, the primary incision is so made as to pass obliquely through the tarsus; 2nd, the flap is derived from the lip, and is fastened into place by means of stitches; 3rd, there are no retentior sutures in the skin of the lid.

The immediate result of the foregoing operations is satisfactory, both in trichiasis and in entropion. By their performance the irritating lashes are shifted well out of the way. Within three to six months, however, relapses are common, an unfortunate occurrence for which there seem to be two chief causes. The first—which has been already alluded to—is due to the fact that operation has been undertaken before the cicatricial processes of trachoma have come to

a standstill. The second has to do with the healing of the wound. After both the Jaesche-Arlt and the Van Millingen methods, a raw surface is left between the lips of the intermarginal incision. Although this surface is covered by a graft of skin in the first, and of mucous membrane in the second instance, it heals nevertheless wholly or in part by the production of cicatricial tissue, which, by its innate tendency to contract in the course of time, displaces once more the cilia. Under these circumstances, there is no objection to repeating the operation, although such repetition has limits. Thus, it is clear that if too much skin be removed from the upper lid, there will be a

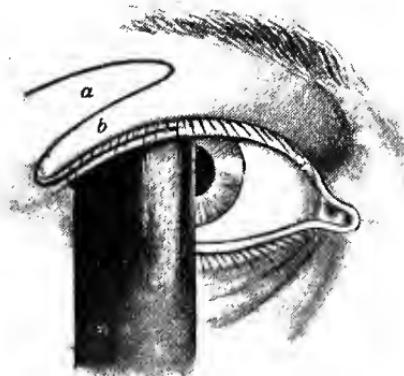


FIG. 11.—Spencer Watson's operation (from CZERMAK). *a*, The skin flap; *b*, the cilia-bearing flap. (Jaeger's "horn-plate" is shown as passed behind the lid so as to steady the parts during the making of the incisions).

risk of producing lagophthalmus, or, in plainer language, the patient will be unable to close his eye. In order to avoid that contingency, it is often advisable to adopt Spencer Watson's ingenious method of transplantation.

Spencer Watson's²³⁷ operation, although somewhat complicated in description, is simple enough in performance. It essentially consists in transposing two flaps provided with pedicles, of which the first is composed of skin, while the second bears the lashes. Its method of performance is as follows:—An intermarginal section is made, the length of which must correspond with that of the trichiasis. A second

incision is then carried through the skin of the lid, at right angles to the intermarginal incision, which it joins at one extremity. Its other end will remain attached to the skin of the lid. In this way a flap will be formed that bears all the ill-directed cilia. Next, another flap, also provided with a pedicle, is cut from the integument of the lid, and the two are made to change places. Both are secured in their new positions by a few points of fine silk. A glance at the appended diagrams (Figs. 11 and 12) will render the details of operation clear.

Spencer Watson's method is most suitable for incomplete trichiasis



FIG. 12.—Spencer Watson's operation (from CZERMAK). *a*, The skin flap; *b*, the cilia-bearing flap. Condition of parts after the flaps (*a* and *b*) have been made to change places. The lashes are seen to be shifted well away from the eye.

more especially if the distorted hairs lie either at the inner or the outer canthus of the lid. In my own experience, however, it has yielded excellent results even when one-half of the lid was involved. It is, of course, useless in entropion.

The only objection that can be raised to the operation is founded upon the fact that the skin flap may be covered with thin hairs, which at times give rise to almost as much irritation as trichiasis itself. They are so exceedingly fine, moreover, as to be beyond the reach of epilation.

Many surgeons before operating for trichiasis fix the lid in what is

termed a Snellen's clamp. The instrument has the great advantage of rendering the incisions almost bloodless, but a good deal of oozing often follows its removal. Indeed, now and then a profuse and long continued flow may be witnessed. The clamp, furthermore, not infrequently hampers the movements of the operator's knife. In my own work, therefore, I have replaced the instrument by a method of elastic compression, the details of which may be thus described:—The materials needed are—(1) a 1-inch toilet pin provided with a solid glass head, and (2) a $\frac{1}{2}$ -inch band of stout rubber. After the pin has been slipped through one end of the band, it is run through the skin and conjunctiva at the inner end of the lid. It is then

Elastic band.

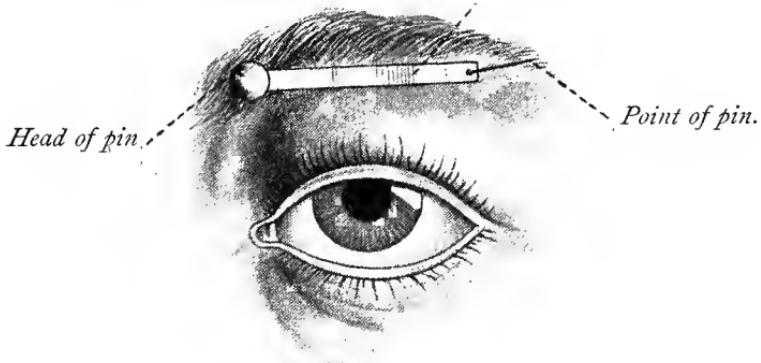


FIG. 13.—The “brooch-pin tourniquet” in position.

passed across the cul-de-sac, and afterwards pushed through the outer end of the lid from conjunctiva to skin. Lastly, the elastic band is tightly stretched, and fixed on the projecting point of the toilet pin. The tissues of the lid are in this way compressed between the pin and the band, and bleeding, although not altogether done away with, is much reduced. The “brooch-pin tourniquet,” as we may style the little apparatus, does not interfere in the least with the surgeon's movements.

After any of the foregoing operations, the wound should be covered with a strip of sterilised “protective” or gold-beater's skin, retained in place by a pedgelet of alembroth wool. An eye-pad and

a carefully applied roller will complete the dressing, which need not be changed for two or three days, unless there are special indications to the contrary. Sutures, as a general rule, are removed on the third or fourth day. It is scarcely necessary to add that the parts should be tenderly handled when dressed, as otherwise the graft may be displaced. In my opinion, the patient has a better chance if both eyes be bandaged, at least for the first forty-eight hours after operation.

None of the procedures hitherto described succeed in permanently curing entropion if the tarsus be much incurved. In that event, Green's²³⁸ plan is as good as any other, and may be adopted. The

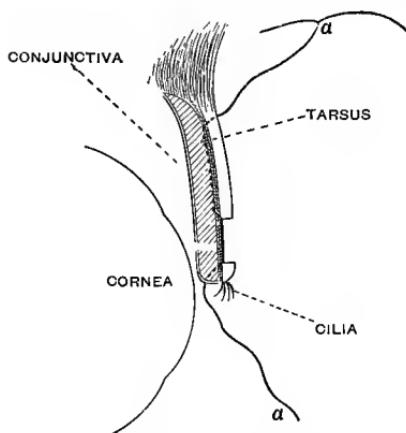


FIG. 14.—Green's operation (diagrammatic representation).

lid is everted, and an incision is made through the conjunctiva and the entire length of the tarsus. It lies parallel with the posterior lip of the intermarginal space, and 2 mm. or 3 mm. away from it. A narrow piece of skin, the ends of which are pointed, is next removed from the surface of the upper lid. It need not exceed 1.5 mm. to 2 mm. in height, and its lower boundary should lie about 1.5 mm. above the line of the eyelashes. It should not include the fibres of the orbicularis muscle. Three or four sutures are then passed as follows:—A curved needle is thrust through the intermarginal space to the inner side of the deviated lashes, and is made to emerge from the lower part of the cutaneous wound. It is next

re-introduced into the upper part of that wound, and passed between skin and tarsus to a point high up on the surface of the lid. By knotting together the free ends of each suture (*a, a*), the divided tarsus will gape, and the skin wound will be closed. At the same time the tarsus will be straightened out, and the margin of the lid restored to its proper position. It is often advisable to turn the eyelashes upwards, and to fix them to the skin of the lid by means of collodion. The stitches are removed a couple of days after operation, by which time, as a rule, the superficial wound will be healed. The tarsal incision, however, fills up by granulation, and will consequently take much longer before union is complete.

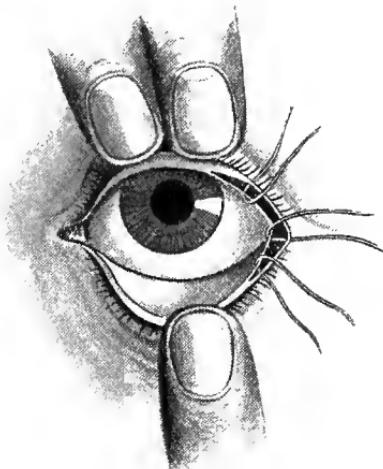


FIG. 15.—Canthoplasty.

Fungoid growths are not uncommon from the latter; they should be snipped away with curved scissors.

It is a good plan, whenever the palpebral fissure is much reduced in size, to perform canthoplasty * before attempting to remedy either trichiasis or entropion. The operation may be done in various ways, but that usually adopted bears the name of Von Ammon. One blade of a pair of blunt-pointed scissors is introduced behind the

* Canthoplasty may be also performed as a preliminary to a course of escharotic treatment whenever the surgeon experiences any difficulty in evertting the lids easily.

external commissure of the lids, which is then slit up by closing the instrument. The line of incision should be a direct continuation of the long axis of the palpebral fissure, and its length will vary according to the result desired. Care should be taken to make the cutaneous wound somewhat longer than the conjunctival one. An assistant next draws the eyelids apart, so that the wound made by the scissors gapes open widely. Skin and conjunctiva are then brought together by three sutures, one above, one below, and one at the terminal point of the incision (Fig. 15). In my own work, I am in the habit of practising the following slight modification. Instead of making a straight incision, I take away bodily a small triangular piece of the tissues at the external canthus. The apex of this triangle is turned towards the temple, its base towards the eye. A small flap of conjunctiva is then raised, and fastened by three sutures to the margins of the first incision.

Before leaving this subject, one may mention that, as a great rarity, the lashes, whilst retaining their natural position, take on an excessive growth. In these cases it seems as though the activity of the hair-follicle were stimulated by the chronic inflammatory processes of trachoma. The following is a good instance:—M.F., eleven years of age. At first sight the right eye appeared to be free from disease, but attentive examination showed that its palpebral conjunctiva was scarred, while the depth of each cul-de-sac was considerably reduced. To put the matter in another way, the eye had at some former time suffered from trachoma, which had undergone spontaneous cure. The lashes of the right upper lid were 6 mm. in length. The left eye, on the other hand, showed obvious signs of active mischief. Thus, its thickened and distorted upper lid drooped markedly; the cornea was hazy from pannus; and an abundance of muco-purulent secretion was present. The conjunctiva, especially of the upper lid, was the seat of active and advanced trachoma. The striking feature of the case, however, lay in the fact that the lashes of the left upper lid were of disproportionate length. They measured, in fact, 12 mm.; that is to say they were twice as long as those of the right upper lid.

ECTROPION.

Ectropion is said to occur as a complication of trachoma, but as I have never observed it personally, there will be no necessity to describe its treatment in this place.

SYMBLEPHARON POSTERIUS.

Symblepharon posterius in some degree forms a sequel to almost every case of severe trachoma. During the cicatrical stage of the malady the retro-tarsal folds—whether superior or inferior—shrink, and become adherent to each other, so that the conjunctival sinus is obliterated to a greater or less extent. The earliest signs of this condition will be found on everting the lower lid, when one or more vertical folds will be seen connecting that structure with the eyeball. Should symblepharon increase, similar folds may be noticed uniting the upper lid to the globe; while, at a later stage, the culs-de-sac may be altogether effaced, or represented merely by shallow grooves.

In the worst cases, the foregoing may pass by insensible gradations into *ZEROPHTHALMUS*, a melancholy condition, in which the conjunctiva has lost all power of moistening the eyeball, while the corneal epithelium has become dry, scaly, and opaque, so that sight is hopelessly lost. Zerophthalmus is not a common sequel of trachoma.

With regard to the treatment of symblepharon and zerophthalmus nothing need be said, for the sufficient reason that they lie beyond the resources of surgical art.

THE TREATMENT OF FOLLICULAR CONJUNCTIVITIS.

FROM a former essay it will have been gathered that, in my opinion, trachoma and follicular conjunctivitis are two distinct affections. Indeed, the points of contrast between them are so marked that it is difficult to understand how they could have been confounded together for so long a period. Trachoma, on the one hand, is contagious, and never arises apart from contagion. It drags a tedious course over many years, and invariably terminates in scarring of the conjunctiva. The malady often entails damage to sight, and is perhaps the commonest cause of trichiasis and entropion. Its cure demands prolonged isolation and systematic treatment. Follicular conjunctivitis, on the other hand, may arise from defective sanitary environment. In the absence of discharge from the eye it is not contagious, while it tends to terminate in speedy and spontaneous cure. It is not associated with pannus or ulcers of the cornea. It never gives rise to serious sequelæ; and, lastly, it soon yields to treatment of a proper kind.

In dealing with follicular disease it is necessary, from a therapeutic standpoint, to distinguish between (*a*) cases without, and (*b*) cases with catarrhal symptoms.

The main features of the first, or non-catarrhal, class may be thus briefly sketched out. The palpebral conjunctiva is not appreciably thickened. It is studded with few or many vesiculo-grains, transparent, rounded or oval in shape, often lying in rows, and seldom exceeding 1 mm. in diameter. As a rule, the membrane is pale, but at times it is reddened by the presence of arborescent vessels. While this latter condition is more or less common, especially as regards the lower lid, it is important to note that diffuse congestion

is never present ; nor is there any discharge from the eye. It would be impossible to adopt a better name for this non-catarrhal class than that proposed by Adamiuk, viz. :—Folliculosis.

The catarrhal cases are distinguished by secretion, which may be either mucous or muco-purulent. In the slighter forms there is no discharge during the day time, but enquiry will elicit the fact that the lids are glued together, or, in common parlance, “stuck,” by dried secretion in the morning when the patient first awakes. In severer forms, dried particles of discharge may be observed in the canthi and about the cilia, or strings of a similiar material may be lying in the culs-de-sac. The palpebral conjunctiva contains vesiculo-grains, which are generally larger and more numerous, as well as more opaque, than is the case in simple folliculosis. The membrane may be somewhat thickened, and is always injected ; that is to say, redness will be present which may be best described as uniform or diffuse in its distribution. A common appearance is that of small white spots upon the tarsal conjunctiva of the upper lid. These are in reality vesiculo-grains, flattened by the pressure to which their position exposes them. The term “follicular conjunctivitis” should, strictly speaking, be reserved exclusively for this catarrhal class.

It is obvious, then, that follicular conjunctivitis is merely folliculosis, *plus* catarrhal symptoms. Both are more or less chronic conditions, which affect children in preference to adults. The changes are always more marked in the lower than in the upper lids.

Treatment may be described under two heads—general and special.

The general treatment both of folliculosis and of follicular catarrh is identical, and may be summed up by saying that the laws of healthy life must be carefully observed. Thus, the patient should dwell amid wholesome surroundings ; many cases are speedily cured by the simple change from a damp, unhealthy site to one that is dry and bracing. Particular attention should be paid to ventilation, especially of sleeping apartments ; ample floor space should be provided. Close confinement indoors is to be avoided, and outdoor exercise should be insisted upon. The dietary should be on a

liberal scale, and frequent variations are desirable, more particularly when dealing with the inmates of schools, parochial or otherwise. In children it is of importance that sufficient fat be given, if needful under the guise of cocoa or milk, butter or dripping. Schooling or other occupation must be carried on under good conditions of hygiene, while any work under artificial light should be discouraged. Clothing ought to be warm, and flannel next the skin is desirable. If the patient be the subject of any constitutional ailment—as scrofula or rachitis—proper treatment must be enforced; and, in general terms, every care should be taken to build up tissue and increase nutrition by the administration of such drugs as cod-liver oil, iron, and bark. To sum up, the keynotes of a successful general treatment are an abundance of fresh air, ample and varied food, warm clothing, together with judicious occupation and exercise.

At one time and another, I have made a good many experiments in order to ascertain whether the so-called alterative drugs would benefit these follicular conditions. In this way, the mercurial preparations have had a fairly extensive trial, while iodide of potassium has been given in quantity amounting to 150 grains *per diem*. Arsenic, antimony, sulphur, and the hypophosphites have been also tried. In no case, however, have I had reason to believe that any good has been thereby effected.

The special treatment of the two ailments consists in the skilful and systematic use of various local remedies. That of folliculosis may be dismissed in few words. If vesiculo-grains be not specially numerous, if their size be small, and if their existence cause no discomfort, then no special medication should be adopted. The case, however, should be watched, and steps taken to notify the surgeon if discharge of any kind be observed.

When the palpebral overgrowths are large or numerous, the treatment will be similar to that for the catarrhal form now to be described.

The most useful treatment, in my experience, is by ointments containing lead. The sub-acetate salt is selected, and care must be

taken that it is thoroughly pulverised before compounding the ointment. If this precaution be neglected, coarse particles are liable to adhere to the conjunctiva, thereby giving rise to local ulceration and discomfort. It is surprising to notice the tenacity with which such morsels cling to the mucous membrane, and I have seen them remain attached for as long as six months. To resume, my usual plan is to commence the treatment with a 1 per cent. ointment, applied twice a day. It should be brought into contact with the conjunctiva of the everted lids by means of a small camel hair brush. After the lids have been allowed to return to their normal position, they should be gently rubbed with the pulp of the forefinger, so as to diffuse the ointment over the mucous membrane. A fortnight later, the strength of the remedy is increased to 2 per cent. If that does not suffice, it may be made still stronger, and occasionally it becomes necessary to employ a 5 per cent. proportion.

Under this treatment the vesiculo-grains become smaller, and now and then disappear completely. Congestion and discharge are at the same time reduced, and the conjunctiva gets into a condition that for all practical purposes may be regarded as healthy.

Another plan that sometimes succeeds equally well is to paint the everted conjunctiva once a day with *liquor plumbi subacetatis*, which need not be washed away with water. The cautions already given about lead, when speaking of trachoma, must, of course, be borne in mind in this connection (p. 189).

If the catarrhal symptoms preponderate over the structural changes—in other words, if much discharge be present—it will be advisable to commence treatment by using, three to six times a day, a tepid solution of corrosive sublimate, 1 to 5,000. This lotion should be applied in the way already described (p. 192). A saturated solution of boracic acid is also useful, or, indeed, any of the lotions mentioned in the section on trachoma. Later, when the discharge has been lessened, recourse may be had to lead ointment, the influence of which in promoting absorption of the growths is sometimes surprising.

Cupric sulphate in ointment form has been recommended by some

writers. It is used in strengths that range from $\frac{1}{2}$ per cent. to 3 per cent., applied twice or thrice in the twenty-four hours. For my own part, I have obtained no striking success from the method, which has often set up a considerable amount of irritation. It appears to me, therefore, inferior to the lead treatment.

The application of strong remedies in these cases is often attended with risk. In particular instances, it is true, they agree well, but I am bound to confess that I have never been able to discover any definite indication as to their use. There can be no doubt, however, that at times they are quite capable of giving rise to increased redness and thickening of the conjunctiva, in short, to a species of spurious trachoma. Bluestone, therefore, should be reserved for cases which refuse to yield to simpler plans. If its use be decided on, the escharotic should be lightly applied (as a general rule, not oftener than thrice a week), and whenever a decided impression has been made upon the vesiculo-grains, a milder remedy should be substituted.

There is a special use of silver nitrate, however, that deserves a passing mention. I refer to the daily application of a $\frac{1}{2}$ per cent. solution, painted on the conjunctiva in the usual way. The action of the liquid should, as far as possible, be limited to the actual over-growths, and it is generally advisable to soak up any surplus by means of absorbent wool. I have not infrequently seen obstinate cases yield to this method. But, for my own part, I avoid the stronger solutions, because they often seem to do more harm than good.

The operation of "expression" may be also employed, but only when the growths are of comparatively large size, and cannot be got rid of by lead ointment, or by the application of the antiseptic or astringent lotions already named. It is in these cases a simple matter to seize and crush each individual follicle with dissecting forceps, and if the growths be present in the upper retro-tarsal fold, the roller forceps may be lightly applied in a manner described when speaking of the surgical treatment of trachoma. Beyond this, nothing need be done in the majority of cases.

Another plan that may be adopted is to touch each individual follicle with the galvano-cautery, but the method should be reserved for cases where the growths are specially large and luxuriant. A few drops of a 2 per cent. cocaine solution are first applied, the lids everted, and their mucous membrane carefully dried by a morsel of absorbent wool. Next, the point of the glowing wire is brought into contact for two or three seconds with the most prominent growths, and made to penetrate into their substance. Anything like general cauterisation must be avoided. Two to five vesiculo-grains may be destroyed at each sitting, but the cautery should not be applied a second time until the irritation of the first operation has passed away, a process that generally occupies about a week. The procedure is practically painless, and no special instruments are needed beyond the galvano-cautery (Fig. 16). On an emergency, even that may be

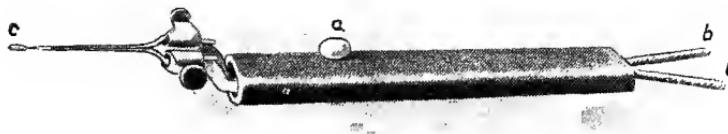


FIG. 16.—A convenient form of galvano-cautery for destroying vesiculo-grains. It consists of a Schech's simple handle, a press button or key (*a*), wires (*b*, *b*) to connect to battery, and a platinum cautery burner of knife shape (*c*).

dispensed with, and a white-hot knitting needle used in its stead. It is worth while pointing out that any prolonged exposure of the conjunctiva makes the operation difficult, because the quickly resulting hyperæmia may obscure even large vesiculo-grains. In my own work, a thin layer of boric acid is sprinkled over the conjunctiva after the cauterisation, and the application is repeated daily until the inflammation has subsided.

One can hardly repeat too often, however, that these follicular conditions of the conjunctiva are of an innocent nature, and entail no serious consequences. It is only when they occur in marked form that they demand anything like active treatment.

Before leaving this subject, one further fact should be mentioned, viz., that an eruption of follicles now and then follows the application

of certain drugs to the eye, as for example, atropine, physostigmine, and cocaine. This occurs under two conditions. In the first—usually after the agents have been used for some days or weeks—an acute ophthalmia, resembling the muco-purulent form, sets in suddenly. On everting the lids, the palpebral conjunctiva is found to be strewn with closely set, non-transparent follicles, which vary in size and number in different cases. This form is not rare amongst children. In the second type—which may follow a single local application—the skin of the lids becomes dry, red, and sometimes looks almost erysipelatous. At the same time, an eruption of transparent follicles is observed, especially in the lower retro-tarsal fold. As a general rule, however, the ordinary symptoms of conjunctivitis are wanting. This second form, so far as I know, is confined to adults.

Without attempting to discuss the causes of the foregoing conditions, it may be pointed out that the chief reasons assigned for them are:—First, personal idiosyncracy; second, an impurity of the drug, either chemical or septic; third, infection from a diseased eye, the *materies morbi* being passed by a common use of the pipette, or in some similar way; fourth, paralysis of the vaso-motor nerves and consequent dilatation of the blood vessels of the conjunctiva (Glorieux²⁴²).

The toxic inflammation is to be met by withdrawing the irritating agent at once, and by the application of a metallic astringent. The preparations of lead possess a special value in these conditions, and often succeed best in the form of hot compresses of the *liquor plumbi subacetatis dilutus*.

APPENDIX.

LAVATORY ARRANGEMENTS.

IN an earlier part of this volume ophthalmia was shown to be often spread by imperfect washing arrangements, and an opinion was expressed that special precautions should be adopted in order to meet the danger. In the present appendix a short account will be given of the contrivances—mechanical and otherwise—which have been found useful for that purpose.

It will simplify matters if the subject be discussed under two heads: first, washing and bathing; secondly, the management of accessories, such as towels, sponges, flannels, and soap.

WASHING AND BATHING.

It should be an absolute rule in every boarding school (or other institution where children have to wash their faces) for each scholar to have a washing utensil of his own, to be retained for his exclusive use. The bowls—which may be of earthenware or enamelled iron—should be marked or numbered in such a way as to be readily distinguished, and the scholars should be drilled into using them properly. In the case of small, good class schools, where expenditure is not limited, there would be no objection to fixed lavatory basins—“plug” or “tip-up”—as long as a sufficient number were provided to allow of each child having his own.

The provision of a separate bowl or basin, however, is in many instances impracticable, under which circumstances washing may be carried out at a stream of running water. The simplest way is to

provide taps for the purpose, but in actual practice this plan is often elaborated into what is known as the "jet system," which renders it impossible for the same water to be used by more than one individual.

There is a good deal of variety in particular apparatus, but, generally speaking, a horizontal supply pipe—perforated at intervals, and fitted with nozzles—is the basis of all the forms in common use. The children wash in the streams that run from the nozzles, and the waste water falls into a receptacle fixed at some distance beneath.

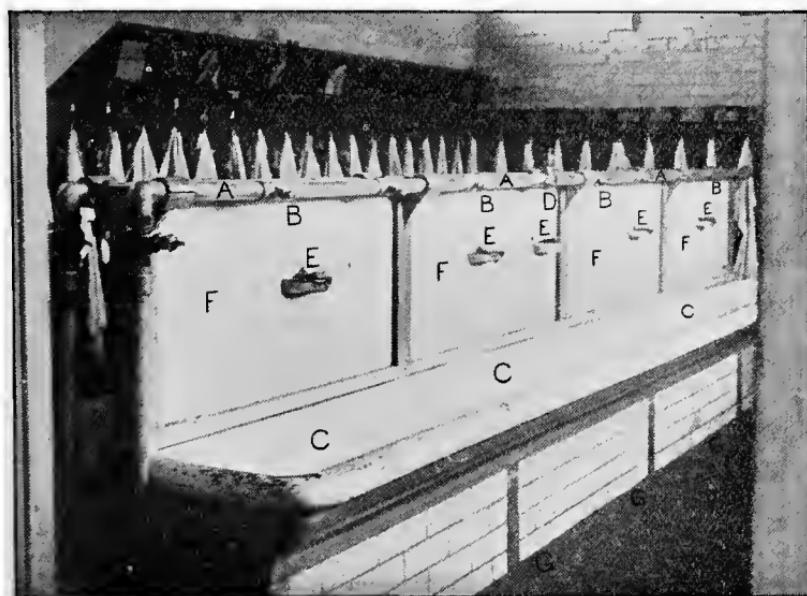


FIG. 17.—One of the lavatories at the Hanwell School.
(For explanation of the letters, *see* Text.)

The latter is so arranged that its contents flow away rapidly, and precautions are usually taken to prevent its outlet being stopped, either purposely or by accident.

Figure 17 (reproduced from a photograph of one of the lavatories at the Central London District School) may be taken as representing a good type of apparatus. It shows a supply pipe (A) running from end to end of the contrivance, and provided with a series of projecting nozzles (B, B). This pipe is 16 feet in length, while its diameter is $1\frac{3}{4}$ inches. The nozzles—of which there are nine on

each side—are 20 inches apart, and are of the simplest possible construction: each one consists of a conical piece of brass, perforated on its under surface by three fine holes, and screwed into a corresponding socket on the distribution pipe. The trough (C) is of semi-cylindrical shape, constructed of four foot lengths of enamelled earthenware, cemented together at the junctions. Its length is 16 feet, its width 14 inches, and its depth 8 inches. It is supported by tiers of glazed bricks, and its upper margin is separated from the jets by a distance of 22 inches, so as to leave ample space for washing. The trough has a fall of 1 inch in 16 feet, and its outlet is shielded by a 4-inch grating. A stopcock (D) throws out of action all the jets except four, and thus prevents unnecessary waste of water when one or two children only are washing. Five receptacles for soap (E, E) are provided for every nine nozzles. Each is a semi-oval plate of enamelled slate, hollowed out to contain the cake, and cemented to the central screen (F), which is also constructed of slate. Lastly, the floor is covered with 4-inch red paving tiles laid in Portland cement, and given a fall towards a 3-inch channel (G) at the base of the enamelled bricks. By that means, water that may happen to be splashed about is got rid of quickly.

The earthenware trough is in many instances replaced by a slate slab, set at an acute angle with the central partition that carries the supply pipe and its attached jets. An open channel is thus left to catch and carry off the waste. Figure 18 gives a good general idea of the arrangement. This form of apparatus looks nothing like so well as that described first. It is, however, cheaper, and it possesses the great advantage that by no possibility can the waste channel be used to wash in.

Instead of nozzles, groups of small holes may be bored through the under surface of the delivery pipe. But the disadvantage of this plan is that the perforations speedily become choked by rust, and hence need constant attention.

The principles that should be attended to in erecting jets for washing purposes may be thus epitomised:—

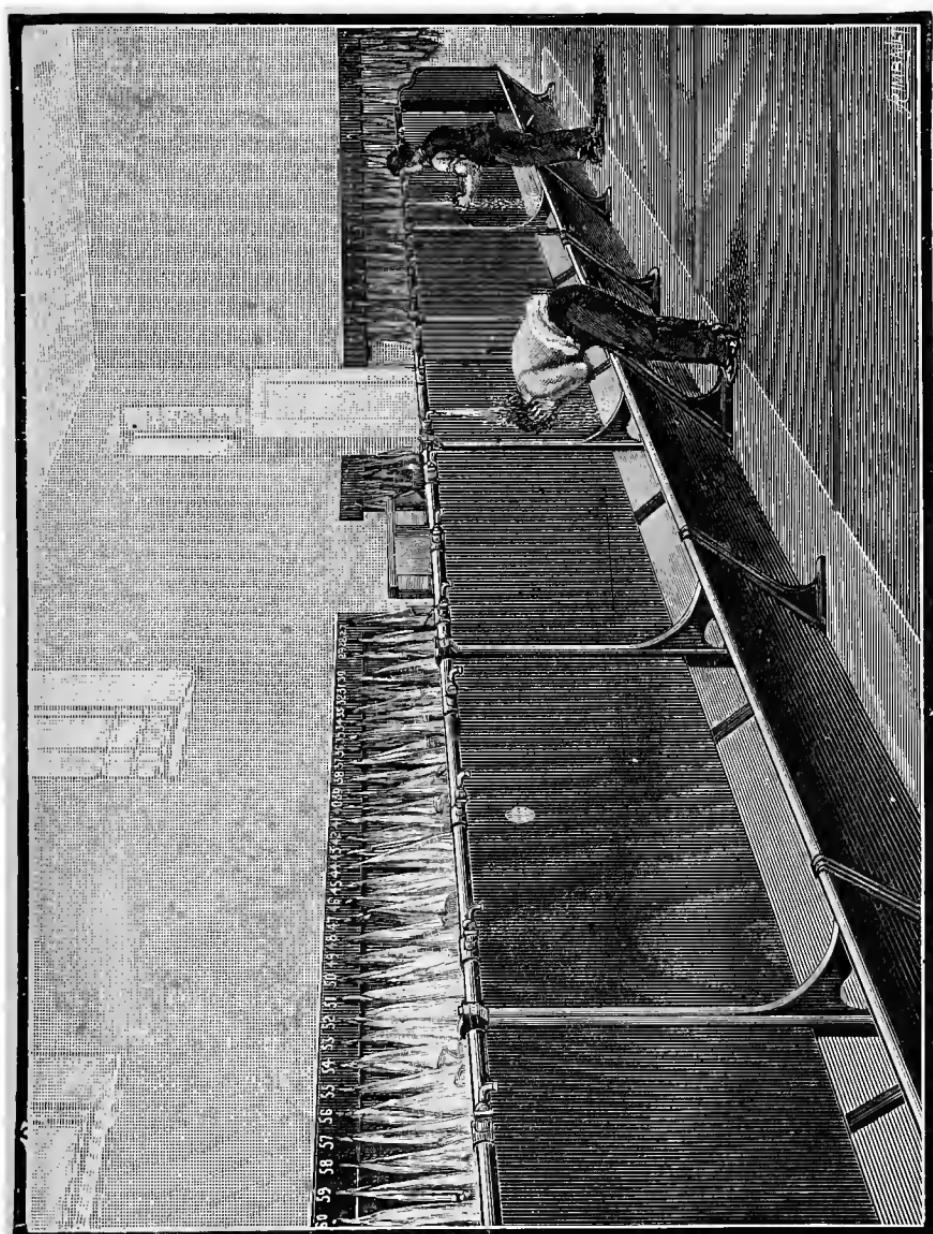


FIG 18.—Lavatory arranged on jet system and provided with slate screens. The illustration also shows a simple way of suspending towels from numbered pegs arranged around the room.

1. Hot and cold water should be supplied, and thoroughly mixed in a special chamber. The latter should be provided with a thermometer, so that the temperature may be regulated.

2. The nozzles should be of simple construction. Fancy patterns ought to be avoided in view of the mischievous tendencies of children. A good form is a simple knob, the under surface of which is bevelled away and perforated by three to five small holes. The "spread" of the water need never exceed six inches—that is, about the width of outspread palms—at the level of the trough.

3. Individual jets should be at least 18 inches apart, so as to provide plenty of elbow room and to prevent any possibility of two children using water from the same nozzle. They should be fixed high enough above the troughs to allow lads, if necessary, to douche their heads; 20 inches, measured from the brim of the trough to the nozzle, represents a good distance.

4. As to number, jets should be provided for at least one-third of the total inmates.

5. The troughs into which the waste water falls should be wholly constructed of some non-absorbent material that can be easily scrubbed down and disinfected. Glazed stoneware or earthenware is perhaps the best for this purpose, and enamelled slate is good, but chips rather readily. Wood ought never to be employed; it is capable of retaining germs and other organic particles, and is liable to become covered by a species of fungus, and to rot away.

As to shape, the trough should in section be semicircular, and this forms one objection to the use of slate. Angular patterns are to be condemned, inasmuch as they offer facilities for the lodgment of filth, which is allied to disease no less by ancient tradition than in the light of modern scientific discovery.

6. It is of importance that the troughs be given a good fall, in order that dirty water may rapidly flow away; 1 inch in 10 feet is ample for the purpose. Furthermore, the exit should be large enough to prevent children readily stuffing it up with towels or other foreign bodies, so as to enjoy a wash in the trough itself.

The waste pipe should pass through an external wall to discharge into the open air over a grated opening.

Evidently, the troughs should be lower for the younger children, and they should be arranged with a view to prevent undue splashing.

7. A simple arrangement of valves should be provided, so that a given number of jets may be thrown into action at any one time. I have often seen twenty nozzles at work when one would have sufficed.

8. Lastly, the floor of the lavatory should be faced with Portland cement or covered with tiles, and given an adequate fall towards one or more gulleys. Wooden racks, like those used in wash-houses, ought to be provided for the children to stand upon.

Before leaving the subject of washing, a word may be added with regard to a simple device whereby fixed basins can be altered so as to be used without danger of infection. A tube connected with the supply is brought up through the plug-hole of the basin, and its free end is capped with a rose pierced by a number of fine apertures. In this way an ascending douche of water is obtained, and by that means washing may be carried on in comfort. The waste is not allowed to accumulate in the bowl, but flows away at once by the sides of the supply pipe, that is to say, by the original outlet of the basin.

Ordinary plunge baths may, of course, be used for bathing if a sufficient number be provided and separate water given to each bather. As to the first point, much will depend upon the proportion of attendants to inmates, and also upon the ages of the latter. As a general rule, however, one bath to every fifteen children will be found enough.

Special tubs are used in some institutions for the younger children. Those employed at the Central London District School are shown in Figure 19, and were supplied by Rufford & Co., of Stourbridge. They are of oblong shape, their length being 33 inches, their breadth 21 inches, and their depth 13½ inches. Their cubic capacity is 8,712 square inches. They are constructed of earthenware, glazed white both inside and outside. As shown by the figure, they are

arranged in pairs, and raised a foot from the ground by four tiers of enamelled bricks. They are filled by ordinary hot and cold water supply cocks, and can be rapidly emptied by a large exit, the valve of which is arranged in such a way as to be under the control of an attendant's foot.

These tubs possess certain definite advantages over the plunge baths in common use. Thus, they are simple, convenient, and cleanly; they are readily disinfected; their original cost is small; they take up little space; and they are quickly filled and emptied.

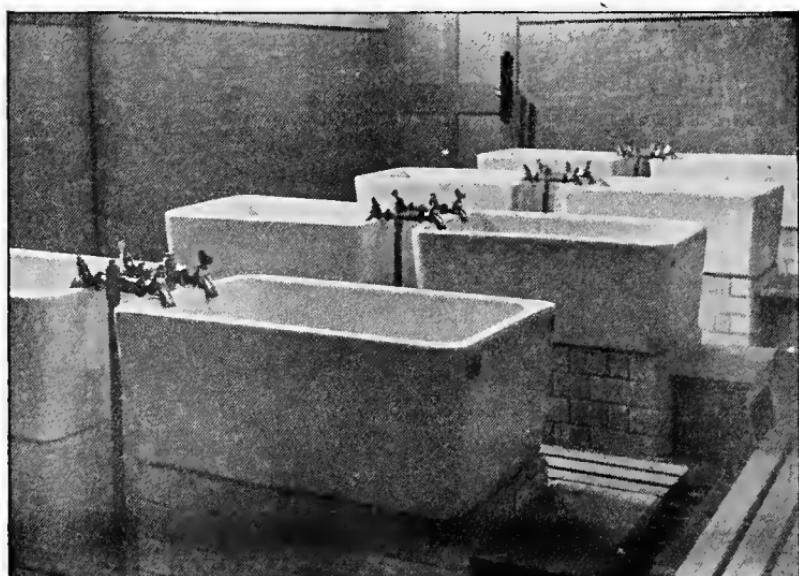


FIG. 19.—Earthenware tubs used at the Hanwell School for bathing the younger children.

The last point is important, inasmuch as it increases the likelihood that each bather will be provided with separate water. In short, these earthenware tubs are suitable, and may well replace the ordinary plunge bath for children under ten years of age.

As to number, for babies—*i.e.*, infants under three years—one tub should be provided for every five children, while one to fifteen would suffice for older inmates.

Neither plunge baths nor porcelain tubs, however, form an ideal

means of bathing, a process that is much better carried out by a modification of the "jet system" of washing.

The principle of the spray bath may be almost indefinitely extended. Only a few of its more useful forms will be now described.

In the barracks of the Emperor Francis Grenadier Guards in the Blücherstrasse at Berlin, a large room in the basement of the building is devoted to bathing purposes. It is divided by a partition into two rows of compartments, each of which is 3 feet 3 inches broad by 5 feet 8 inches high. The main distribution pipe extends lengthwise above the partition in such a way that two sprays project into each cell. The sprays—which are oblong and perforated by a number of finely drilled and closely set holes—are fixed obliquely, so that water, instead of falling directly upon the head of the bather, is directed towards his neck and chest. There are in all eighteen available compartments; and it is stated, upon good authority, that 300 men may be bathed in a single hour, the quantity of water for each bather averaging 15 to 20 quarts.*

In this country a somewhat similar apparatus has been erected by Messrs. Finch & Co. at the North-Eastern Company's Schools at Newcastle-on-Tyne.

The Leavesden School possesses a number of baths, the construction of which is simplicity itself. Each one consists of an overhead metal tray, perforated by numerous $\frac{1}{8}$ -in. apertures, and connected with a supply of tepid water. The tray is of oblong shape, and measures 6 feet by 2 feet 8 inches. Its edges are turned up, in order to prevent the water from overflowing. It is suspended by hook-bolts at a height of 6 feet 8 inches above a shallow pit (8 feet 6 inches by 4 feet 6 inches by 2 feet 10 inches) lined with white glazed tiles. The children stand in batches of 10-15 beneath the metal screen, and the water descends upon them in a sort of shower. The superintendent of the school (Mr. G. Rule) reports that these "sprinkle baths" act excellently, and that the

* The reader will find full particulars concerning this bath in a pamphlet written by Mr. David Grove, and published by George Jennings, Stangate, S.E.

boys may be bathed in this way at the rate of 100 per hour. The details of construction are shown in the appended plans (Figs. 20-22).

Another device is to provide a sunken space of some depth in the floor of the bathroom, and to cement it at the sides and bottom. Around three sides of this pit there is a supply pipe, armed with a

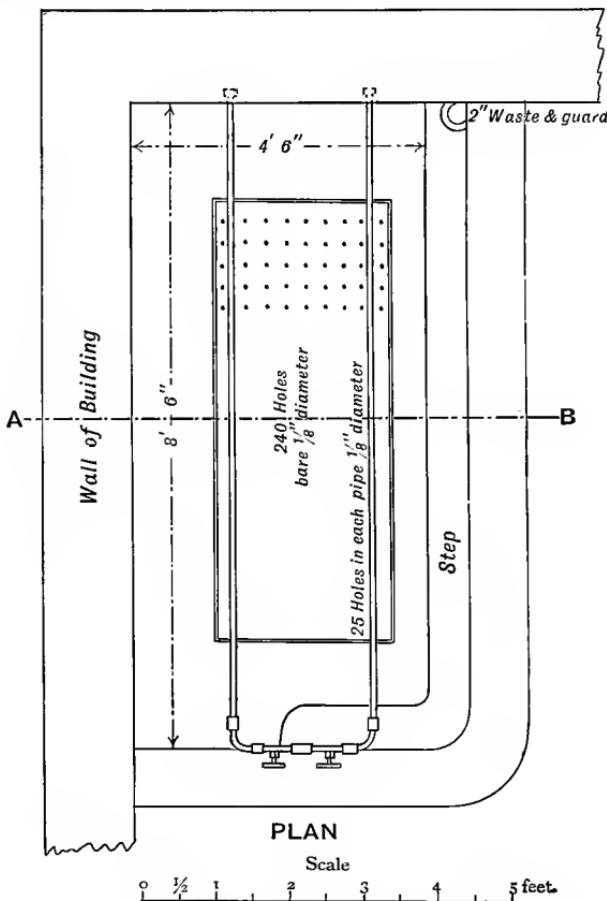


FIG. 20.—Plan showing construction of the “Sprinkle Baths” at the Leavesden Schools.

series of fair-sized roses, set at a convenient angle. The children take their places in the bath, stationing themselves so that the jets play over their bodies. Large exit holes are provided for the waste water, which is thus prevented from accumulating at the bottom of the receptacle.

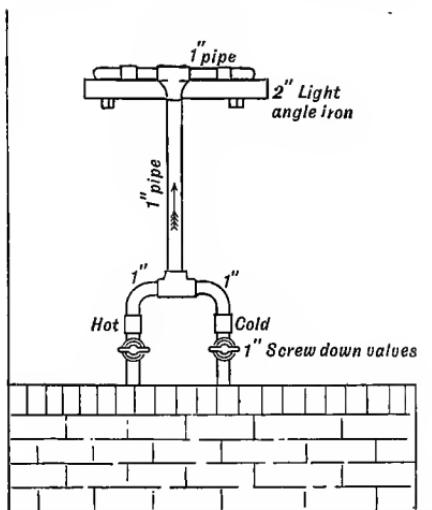


FIG. 21.

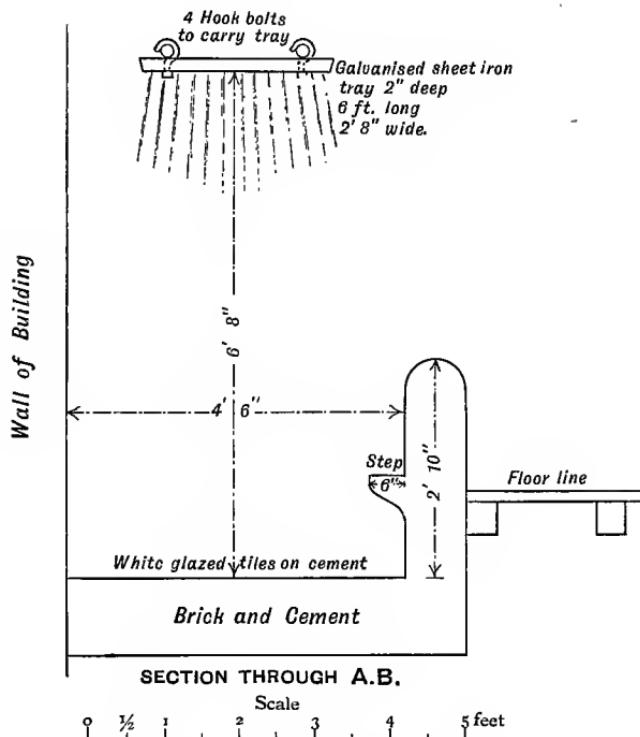


FIG. 22.

Plans showing construction of the "Sprinkle Baths" at the Leavesden Schools.

The spray bath shown in Figure 23 represents the only kind of bath in use at the Ophthalmic School. It consists of a slate case provided with wooden doors, the water being supplied by an iron service pipe running round the interior of the compartment, and supplied with seven perforated nozzles. Directly a child steps into

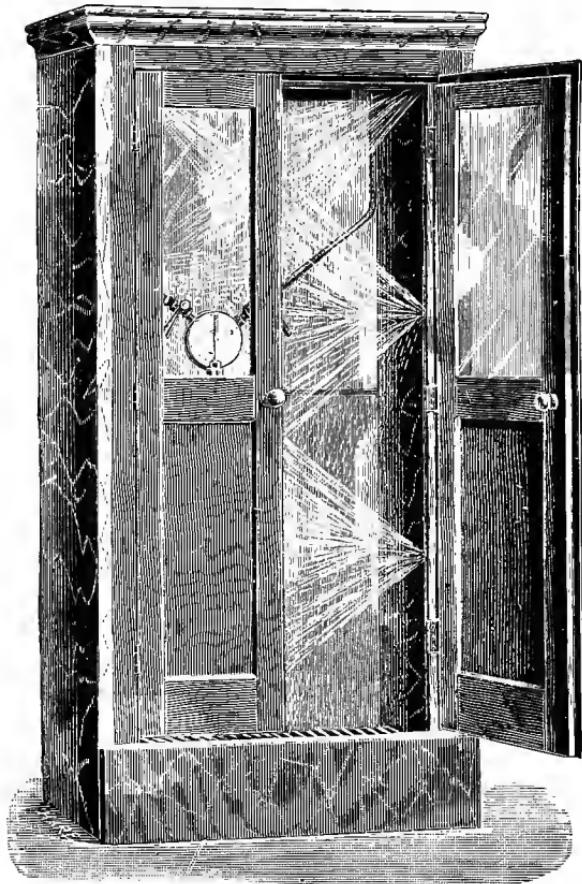


FIG. 23.—Spray bath similar to that used in the Ophthalmic School.

the chamber, his weight opens certain valves, and the jets shower a fine spray over his whole body. The temperature of the water is ascertained by a thermometer either in the bath or immersed in a mixing chamber outside the apparatus. From the bottom of the bath a 2-inch waste leads into an open air channel outside the

lavatory. The most recent pattern (Fig. 24) is provided with a hinged flap seat inside the bath, so that a child is enabled to sit down and wash his feet. Our experience is that one spray bath is enough for twenty-five patients.

Among the many advantages possessed by spray baths, the following may be enumerated :—

(1.) It is impossible for the same water to be used by more than one child. Hence it follows that the passage of a contagious disease, as ophthalmia, by means of water is rendered impossible, while, at the same time, the evils of a careless supervision are avoided.

(2.) A great saving of water is effected, which means a corresponding economy in fuel and in labour.

(3.) Children can be rapidly bathed. Repeated experiments at the Ophthalmic School have shown that the time consumed by each patient in the bath varies from 1·07 to 2·3 minutes.

(4.) The apparatus is always ready for immediate use.

In short, our own experience has shown that, while sprays possess decided advantages, they are every whit as efficient as ordinary baths. They ought, in my opinion, to be erected whenever many individuals—more especially children—are lodged beneath a common roof. The only exception is in the case of babies, who may be bathed in the porcelain baths already described, or even cleansed under the jets of the washing apparatus.

A word may be added in respect of swimming baths, which are needed less for cleansing purposes than as a valuable means of physical exercise. Soap, therefore, should not be used in the swimming bath. If children are noticed to be dirty before entering the bath they should be made to cleanse themselves at a spray, of which one or two should be provided somewhere near at hand. Figure 24 represents the sprays fixed by Messrs. B. Finch & Co. in the Strand Schools at Edmonton, where every child is required to pass through the shower before he is allowed to enter the swimming bath.*

* Messrs. B. Finch & Co. (of Lambeth, S.E.), who make a specialty of spray baths, also supplied the apparatus in the Ophthalmic School.



FIG. 24.—Spray baths used at the Strand Schools. The lad in the right hand compartment is having a body douche, while the one in the other compartment is washing his feet at an ascending spray.

THE MANAGEMENT OF ACCESSORIES.

Towels.—It should be a fixed rule for each child to keep to his own towel. That end may be attained in several ways, but two only need be considered in this place, namely, (a) the provision of a clean towel for each wash, and (b) a proper system of marking or numbering the towels.

In theory it would no doubt be correct for each child to be provided with a clean towel on every occasion of washing, and, in point of fact, the plan is adopted in some institutions. It is, however, needlessly extravagant. It throws an unnecessary strain upon the resources of the school, and robs the inmates of that sense of individual ownership so important to foster in the young. Besides, the scarcely soiled linen constitutes an open invitation to slipshod treatment at the laundry. As regards “driers”—that is towels used after the periodical bath—the case is obviously different, and there is no reason in fact why they should not be employed once, and once only, and then sent to the laundry.

The proper plan of dealing with ordinary towels is to mark them legibly with the name of their owners, or else to stamp them with numbers. The lads should be made to understand clearly why this is done. With care at the outset there will be no great difficulty in keeping the articles separate.

Towels are now and then kept over the head of their owners' beds, a practice that cannot be commended, inasmuch as the contained moisture is given off to the air of the dormitory. They should be kept in the lavatory, suspended from numbered pegs. In the absence of a suitable rack, a strip of deal, six inches in width, may be fastened to the wall of the room. Brass-headed nails are then driven into the strip, and the towels are attached by means of a tape loop. A number or name is painted over each nail (Fig. 18). Care should be taken that towels swing clear of one another, which may be readily done by having a distance of 12-16 inches between the pegs.

Should space be limited, the Norwood plan may be adopted. As shown by Figure 25, a pegged strip of wood is enclosed within a

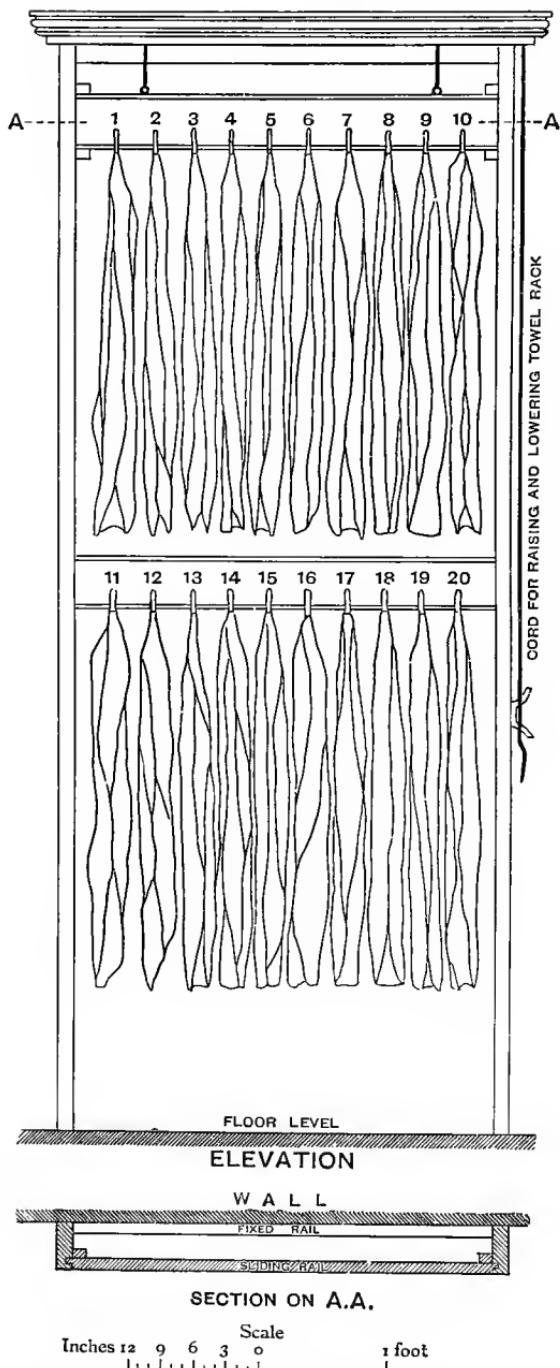


FIG. 25.—The Norwood plan of suspending towels.
(*N.B.*—In practice, the towels should swing clear of one another.)

wooden frame, and is capable of being moved by means of the pulley string. A second pegged bar is immovably nailed across the lower part of the frame. Towels are attached to the upper cross-piece, and then drawn out of the way by the cord of the pulley. In case of need, a second or third immovable bar might, of course, be added.

Sponges and Flannels.—If these articles be allowed at all, they should at least be marked, and each inmate should possess his own. In large schools it is advisable to do away with them altogether; they are not only unnecessary, but constitute an ever present potential danger. Pieces of tow, to be collected and burned after use, are safer, and in the long run do not cost much more. It is almost needless to add that a separate piece must be given to each child.

Soap.—A plain, pure soap should be selected, and it should be kept in suitable receptacles. A wire basket hung over the supply pipe of the washing apparatus is convenient, while it has the additional advantage of being readily cleansed by means of boiling water.

I N D E X.

PAGE	PAGE
Acute Trachoma, 4, 13-15, 64	Bluestone, Forms of, 177
" Treatment of, 191, 192	" Indications for, 177
Adenoid Processes of Childhood, 123-125	Body Apparel and Ophthalmia, 51
" Tissue, 122, 123	Boric Acid in Trachoma, 187
Admissions, 66-68	Boroglyceride, 187, 188
Aerial Infection, 30-35	Brentwood School, 3, 59
Air Bricks, 71	Brooch-pin Tourniquet, 232
" Dampness of, 71, 72	" Brossage," 143
Alum Points, 190	Brushes, 166-168
Alumol, 188	Budapest Blind Asylum, 29
Anerley Schools, Ophthalmia in, 59	Buller's Shield, 192
Animals and spread of Ophthalmia, 51-54	Cantharidate of Potash, 142
Anterior Chamber, Haemorrhage into, 76, 77	Cantharidine, 142
Aphthous Ophthalmia, 6	Canthoplasty, 152, 234, 235
Argenti et Potassii Nitrás, 181	Carbolic Acid, 190
Argyleshire Fencibles, Ophthalmia amongst, 51	" " Lotion, 193
Argyria, 181, 182	Carbol-methylene-Blue, 18
Arlt's Theory, 28, 29	Catarrhal Ophthalmia, 5-80, 20
Arrangements, management of Washing, 244-259	" Bacilli of, 20
Atropine, Abuse of, 195	" " Symptoms of, 5
Attenuation of Ophthalmia, 28	" Varieties of, 5-7
Auto-inoculation, 25, 38	Certificates of Health, 67
Bacilli, Klebs-Löffler, 11, 19	Chemosis, 16
" of Catarrhal Ophthalmia, 20	Chlorine Water, 193
" Ways of Staining, 18	Christ's Hospital, Ophthalmia in, 1, 66
Baths, 249-255	Chromic Acid in Trachoma, 137, 138
Bed-linen and Ophthalmia, 51	Clothing, Infected, Disinfection of, 73
Blennorrhœa, Chronic, 10	" " Washing of, 73
Blepharitis, 8, 212-216, 222	Cocaine, Abuse of, 193
" and Errors of Refraction, 215, 216	Conclusions as to Aerial Spread of Ophthalmia, 35
" Epiphora, 214	" " Epidemic Ophthalmia, 80
" Pediculi, 214, 215	" " Follicular Granulation, 125
" Scrofulosis, 215	" " Treatment of Trachoma, 195, 196
" Shortness of Upper Lid, 214	Compressionists, 133
" Trichiasis, 222	Conjunctiva, Bleeding from, after " Expression," 161-163
" Micro-organisms in, 215	" Follicular Granulation of, 81-125, 237-243
" Treatment of, 212-214	" Haemorrhage into, 76
Blepharoxysis, 126	" Lymphatic Dilatation of, 77
Blisters, 193, 211	" Membranous Inflammation of, 6, 7, 12
Blood-letting, 128, 129	" Phlyctenulæ of, 76
Bluestone, 177, 178, 209	" Scarring of, 102, 103

	PAGE		PAGE
Conjunctiva, Staining of,	181, 182	Epidemic Ophthalmia at Anerley,	59
" Toxic Inflammation of,	242, 243	" " " " "	Brentwood, 3, 59
Conjunctival Granulations,	81-125	" " " " "	Budapest, 29
Contagion,	23, 35-55, 243	" " " " "	Chelsea Military Asylum, 1, 37, 41, 57
" Direct,	35-38	" " " " "	Christ's Hospital, 1, 66
" Indirect,	38-55	" " " " "	Copenhagen, 58
Contagionists,	133	" " " " "	Edmonton, 3
Copper Sulphate (<i>see</i> Bluestone),	177, 209	" " " " "	Forest Gate, 3
Cornea, Circumcision of,	136, 137	" " " " "	German Protestant Asylum, 67
" Paracentesis of,	204-206	" " " " "	Hanwell, 3, 40, 53, 59, 60, 79, 96
" Tonsure of,	136, 137	" " " " "	Leavesden, 3
" Trachoma Granules in,	13	" " " " "	Leytonstone, 3
" Ulceration of, 10, 13, 21, 196-211	196-211	" " " " "	Mons, 61
Corrosive Sublimate,	183-186, 192	" " " " "	Norwood, 3, 59, 78, 95
" Crayon,	185	" " " " "	Philadelphia Hospital, 69
Cotton Wool Holder,	167	" " " " "	St. Petersburg Military Hospital, 61
Cover-glass Preparations,	18	" " " " "	St. Stanislaus Asylum, 61
Croupous Conjunctivitis,	6	" " " " "	Strasburg Civil Hospital, 50
Cubicles,	71	" " " " "	Sutton, 3, 78, 79
Cul-de-sac, Excision of,	143, 147-156	" " " " "	Thildonck, 68
" After-treatment of,	153	" " " " "	Vaucluse Asylum, 52
" Anæsthesia in,	153	" " " " "	Conclusions concerning, 80
" Antiseptics in,	153	" " " " "	Diagnosis of, 15-23
" Cases suitable for,	155	" " " " "	Economic Interests involved by, 3
" Complications of,	154	" " " " "	Evil results of, 2, 3
" Methods of performing,	151, 152	" " " " "	Kinds of, 4-15
" Sequel to,	153	" " " " "	Laws of, 28
Cyanide of Mercury in Trachoma,	186	" " " " "	Management of, 57-80
Cysts, Meibomian,	77	" " " " "	Propagation of, 27-56
Dampness of Air, its connection with Ophthalmia,	71, 72	" " " " "	Ways of spreading, 27-56
Darier's Operation,	145	" " " " "	Epidemics, Influence of surroundings on,
Day Scholars and Ophthalmia,	68, 69	" " " " "	70
Dermatitis,	211, 212	" " " " "	Epithelial Zerosis,
Diagnosis of Acute Ophthalmia,	15-24	" " " " "	77
" Chronic,	100-103	" " " " "	Errors of Refraction and Blepharitis, 215, 216
Dietary,	72	" " " " "	and Pannus, 211
Dilution Experiments,	43, 44	" " " " "	Escharotics,
Diphtheritic Ophthalmia,	11-13	" " " " "	164-192
Direct Contagion,	35-38	" " " " "	" Alternate applications of, 171
Discharge,	17-21, 65	" " " " "	" Best time to apply, 170, 171
Disinfection of Clothes,	73	" " " " "	" Method of applying, 164-168
Dismissal of Ophthalmia Cases,	64-66	" " " " "	" Mode of action of, 175, 176
Distichiasis,	221, 222	" " " " "	" Nervous Symptoms, 168
Dormitories, Arrangement of,	70, 71	" " " " "	" Number of applications, 170
Duration of Acute Ophthalmia,	21, 22	" " " " "	" Pain after, 168, 170
Ectropion,	9, 236		
" Spasmodic,	168		
Edmonton School,	3, 255		
Education of Ophthalmic Patients,	63		
Electricity in Trachoma,	136		
Electrolysis,	76, 225		
Egyptian Ophthalmia,	1, 124, 127-133		
" Nature of,	128		
Enquiry into the Follicular Granulation,	81-125		
Entropion (<i>see</i> Trichiasis),	9, 23, 221-235		

	PAGE		PAGE
Escharotics, Sloughs after,	169	Hæmorrhage beneath Conjunctiva,	76
" Solid and Liquid,	171	" into Anterior Chamber,	76, 77
" Spasmodic Entropion after,	168	Handkerchiefs,	50, 51, 73
Eserine,	203, 243	Hands, Spread of Ophthalmia by,	48-50
Excision of Retro-tarsal Folds,	143, 147-156	Hanwell School, 3, 40, 53, 59, 60, 79, 96,	
" Tarsus,	143	245, 249	
" Expression,	144, 156-164, 241	Heating of Dormitories,	71
" After-treatment of,	161, 162	Hemeralopia,	77
" Anæsthesia in,	159	History, Importance of,	15, 16
" History of,	156, 157	Hooping-Cough and Ophthalmia,	80
" Instruments for,	157, 158	Hordeolum,	76
" Method of performing,	157-161	Hypæma,	76
" Sequels to,	162, 163		
Facette,	204	Immunity,	56
False and true Granulations,	113, 114	Importation of Ophthalmia,	67-69
Flannels for Washing Purposes,	259	Indirect Contagion,	38-55
Flies and Spread of Ophthalmia,	53, 54	Infection, Aerial,	30-35
Floors, Treatment of,	72	Influenza and Ophthalmia,	80
Fluorescine,	202, 203	Inoculation,	27, 35-37, 138, 139
Follicular Conjunctivitis,	236-243	Insanitary Surroundings and Trachoma,	26
" Granulations,	80-125	Investigation into Palpebral Granulations,	91-120
" " and " Adenoid Activity,"	122-125	" Iodic-hydrag,"	185, 186
" " Aggregation,	116, 117	Iodine, Tincture of, in Trachoma,	186
" " Environment,	115-120	" " " Corneal Ulcers,	204
" " its Associations,	120-122	Iodoform,	186
" " Conclusions as to,	125	Idol,	186
" " Definition of term,	100, 101	Iridectomy,	211
" " in Healthy Children,	118	Iritis in Purulent Ophthalmia,	23
" " Life history of,	123-124	" Trachoma,	221
Folliculosis,	26, 81-125, 238	" Irritation Spots,"	173
Foreign Bodies in Eye,	75	Isolation of Ophthalmia Cases,	58-62
Forest Gate School,	3		
Formal,	193		
" Frottage,"	184, 185		
Galvano-Cautery,	144, 242		
General Health and Follicular Granulation,	118		
German Asylum, Ophthalmia in,	67		
Gonococcus,	8, 10, 18, 32		
" Experiments with,	43, 44		
" Methods of Staining,	18		
Gonorrhœa,	124		
Gonorrhœal Ophthalmia,	8		
Graefe's Theory,	27, 28		
Granular Lids (<i>see</i> Trachoma).			
" Pharynx,	120-122		
Granulated Lid,	11		
Granulation, False and True,	113, 114		
" Follicular,	80-125	Lambeth Schools,	3, 59, 78, 95
" History of,	124, 125	Lapis Divinus,	178, 179
Gram's Method,	18, 20	Larisboisière Hospital,	210
" Grattage,"	143	Lashes, Inturned,	75, 76
Green's Operation,	233, 234	Lavatory Arrangements,	72, 73, 244-259
Greenwich Hospital,	129, 130	Laws of Epidemic Ophthalmia,	28
Guthrie's Black Ointment,	134	Lead, Cautions Concerning,	189
		" in Follicular Conjunctivitis,	239, 240
		" in Trachoma,	137, 188, 189
		Leavesden School,	3, 251-253
		Leucoma Adherens,	211
		Leytonstone School,	3
		Lotions,	192, 193, 240
		" Kinds of,	192, 193
		" Methods of Applying,	192
		" Uses of,	192

PAGE	PAGE
Lunar Caustic,	179-183
, , , Dangers of, . . .	180
Management of Epidemic Ophthalmia,	57-80
, , Ophthalmic Patients, .	61
Marquees for Ophthalmia Cases, .	61
Marston's Theory,	84
Massage,	143
Means by which Ophthalmia spreads, .	30-56
Measles,	59, 78-80
, and Leucorrhœa, . . .	80
, at Hanwell School, . . .	79
, Norwood School, . . .	59, 78
, Sutton School, . . .	78, 79
Medical Inspections,	73-78
, , Conditions com- monly found,	75-77
, , Method,	74
, , Number,	74
, Officers of Schools Asso- ciation,	94, 95
Meibomian Cysts,	77
Membranous Conjunctivitis, . . .	12
Merismopedia Gonorrhœa, 8, 10, 18, 19, 32	
, , Ways of Staining, 18	
Methods of securing Isolation, . . .	60, 61
, Staining Organisms, . . .	18-20
Methylene Blue,	18
Methyl Violet,	18
Miasmatic Origin of Ophthalmia, .	23, 55
Microscopical Examination of Dis- charge,	18-21
Micro-organisms, Methods of Staining, 18	
, Catarrhal Ophthal- mia,	8, 20, 21, 24
, Diphtheritic Oph- thalmia,	11, 19, 24
, Purulent Ophthal- mia,	8-10, 18, 20, 24
, Trachoma,	19, 23
Millingen's Operation,	228, 229
Mitigated Silver Stick,	134, 179, 181
Mucocele,	221
Mutermilch's Theory,	91-93
Nasal Glanders and Ophthalmia, .	52
Newcomers, Importance of Examining, 67	
, Probation of,	68
Night Blindness,	77
, Epilepsy,	76
Noiszewski's Operation,	144
Norwood School,	3, 59, 78, 95
Notification, importance of,	73
Nurses, Ways in which they con- tract Ophthalmia,	50, 55
Nursing of Ophthalmia Cases,	64
Operations, Paracentesis,	204-206
, Ptosis,	218-220
, Trachoma,	147-164
, Trichiasis,	224-235
Ophthalmia, Acute, Diagnosis of, .	15-24
, among English Regi- ments,	127, 128
, Population of Copenhagen,	58
, and Animals,	51-54
, Bed Linen,	51
, Body Apparel,	58
, Day Scholars,	68, 69
, Dampness of Air,	71, 72
, Double Beds,	50
, Handkerchiefs,	50, 51
, Hooping Cough,	80
, Immunity,	56
, Impetigo of Face,	8
, Influenza,	8
, Medical Inspections,	
, , , , ,	73-78
, Measles,	78-80
, Nasal Glanders,	52
, Nurses,	50
, Overcrowding,	70, 71
, Rötheln,	80
, Rouget,	52
, Sanitary arrangements, 72	
, Scarlet fever,	80
, the press,	2
, Vaginal discharges, , , , , ,	37, 49, 50, 69, 70
, Variation in type,	28
, Washerwomen,	49
, Washing utensils, , , , , ,	39, 48, 72, 73, 244-259
Aphthous,	6
Arlt's Theory of,	28-59
at Anleyer,	29
Brentwood,	3, 59
Christ's Hospital,	1, 66
Gibraltar,	127
Greenwich Hospital,	129
Hanwell, 3, 40, 53, 59, 60, 96	
Hythe,	127
Kilmarnham,	127, 128
Lambeth,	3, 59, 78
Lisbon Orphanage,	32
Malta,	127
Mons,	61
Vaucluse Asylum,	52
Sicily,	129
St. Petersburg Hospital, 61	
St. Stanislaus Asylum, 61	
Thildonck,	68, 69
Costliness of,	3
Diphtheritic,	11, 13
, , Diagnosis of, 12-13	
Discharge, Examina- tion of,	17-21
Duration of Acute,	21, 22
Economical Aspects of,	3
Egyptian, 1, 2, 124, 127, 133	
Epidemic,	1, 80
, , Laws of,	28

	PAGE		PAGE
Ophthalmia, Evil Consequences of	3	Pannus, Relapses in, . . .	202, 203
" Gonorrhœal, . . .	8	" Setons in, . . .	211
" Importation of, . . .	67-69	" Treatment of, . . .	206-210
" in Badly Managed Schools, . . .	2	" Varieties of, . . .	196, 209
" Belgian Army, . . .	58, 133	Paper-fibre Lint, . . .	165
" British Army, . . .	1, 128	Papillary Granulations, . . .	99-100
" French Army, 1, 127, 128		Paracentesis, . . .	204-206
" German Protestant Asylum, . . .	67	Pediculi Pubis, . . .	214-215
" Parochial Schools, . . .	68	Perotomy, . . .	136-137, 209-210
" Philadelphia Hospital, . . .	69	Phlyctenula, . . .	76
" Isolation of, . . .	58-62	Photophobia, . . .	216-217
" its Supposed Miasmatic Origin, . . .	55	Physostigmine (<i>see</i> Eserine), . . .	203, 243
" Management of, . . .	57-80	" Pink Eye," . . .	52
" Modes of Dissemination, . . .	27-59	Piringer's Dilution Experiments, . . .	43
" Muco-purulent (Catarrhal), . . .	5-8	Pneumococcus, . . .	7
" Neonatorum, . . .	8-11, 37, 24	Pre-auricular Glands, . . .	9-10, 14, 24
" Purulent, . . .	8-11, 24	Probation of Newcomers, . . .	68
" Pustular, . . .	6	Propagation of Ophthalmia, . . .	21-56
" Spread of, . . .	27-57	Psorosperms and Trachoma, . . .	23
" Specificity of, . . .	27, 28	Ptosis, . . .	14, 103, 217-220
" Synovitis in, . . .	24	Pudendal Discharges, 42, 49-50, 69-70, 80	
" Vaginal Discharges and, . . .	37, 49, 50, 69, 70	Purulent Ophthalmia, . . .	8-11
Ophthalmic Patients, Classification of, . . .	64	Pustular, . . .	6
" " Education of, . . .	63	Pyoktanin, . . .	189-190
" " Dismissal of, . . .	64-66		
" " Medical Treatment of, . . .	63, 64		
" " Nursing of, . . .	64		
" " Separation of, . . .	58-62		
" School, References to, . . .	34, 49, 50, 63, 65, 167, 170, 245		
Ophthalmological Society and School of Ophthalmia, . . .	93	Quinine in Photophobia, . . .	217
" Opistoblefari," . . .	136	" Trachoma, . . .	138, 186-187
Overcrowding and Ophthalmia, . . .	70, 71		
Palpebral Gland, . . .	155		
Pannus, 13, 21, 103, 136, 138, 139, 142, 196-211		Regiments, Disbandment of, . . .	58
" Atropine in, . . .	203	Retro-tarsal Folds, Excision of, . . .	143, 147-156
" Blisters in, . . .	211		
" Causes of, . . .	199, 202	Roosbroeck's Experiment, . . .	42, 43
" Clinical History of, . . .	202	Rötheln and Ophthalmia, . . .	80
" Varieties of, . . .	196	Royal Military Asylum, 1, 37, 41, 59, 128	
" Cocaine in, . . .	203	Rouget, . . .	52
" Defects of Sight in, . . .	199		
" Development of, . . .	197	" Sago-grains," Definition of, . . .	99
" Digestive Ferments in, . . .	142, 143	" Description of, . . .	101-102
" Inoculation in, . . .	138, 139	Sal Alembroth in Trachoma, . . .	185
" Iridectomy in, . . .	211	" Scardasso," . . .	135
" Jequirity in, . . .	139-142, 207-209	Scarification, . . .	143
" Naked-eye characters of, . . .	197, 198	Scarlet Fever, . . .	28, 80
" Nomenclature of, . . .	196	Scarring of Conjunctiva, . . .	102-103
" Pathology of, . . .	196	School, Anerley, . . .	59
" Perotomy in, . . .	209, 210	" Bluecoat, . . .	1, 66
		" Breaking up of, . . .	58
		" Brentwood, . . .	3, 59
		" Certificates, . . .	67
		" Dormitories, Floors of, . . .	72
		" Heating of, . . .	71
		" Space in, . . .	72
		" Ventilation of, . . .	71
		" Edmonton, . . .	3, 255
		" Forest Gate, . . .	3
		" Hanwell, 3, 40, 53, 59, 60, 79, 96, 245, 249	
		" House, Arrangements of, . . .	70-73
		" Leavesden, . . .	3, 251-253
		" Leytonstone, . . .	3
		" Medical Inspection of, . . .	73-78
		" Norwood, . . .	3, 59, 78, 95, 257

	PAGE		PAGE
School Ophthalmia,	1-4, 58-60, 93	Trachoma and Erysipelas,	211
, " Ophthalmological Society and,	93	, Folliculosis,	26
, Management of,	57-80	, Iritis,	221
, Outbreaks of,	1-4, 58-60	, Operations,	210, 211
, Ophthalmic,	34, 49, 50, 63, 65, 167	, Photophobia,	216, 217
, Parochial,	170, 254	, Ptosis,	217-220
, Probation in,	2-4, 68	, Scarlet Fever,	210
, Sutton,	68	, Scrofulosis,	194, 195
, Scleral Arc,	3, 78, 79	, Symblepharon Posterius,	236
Scrofulosis,	194, 195, 215	, Trichiasis,	221-235
Setons,	193, 211	, Zerophthalmus,	236
Sherrington's Valves,	71	Aniline Colours in,	138, 189, 190
Snellen's Clamp,	231, 232	Atropine in,	193
, Thread Operation,	218, 219	Boric Acid in,	187
Soap,	259	Boroglyceride in,	187
Specificity of Ophthalmia,	27, 28	Carbolic Acid in,	190
Sponges,	41, 259	Chronic,	23-26
, and Contagion,	41	, assumed Protozoic	
, Management of,	259	, Origin of,	23
Spray Baths,	254, 255	, Unilateral,	25
Sprinkle Baths,	251-253	, " Fallacies	
Staphyloma,	211	, about,	25
Staining Fluids,	18	Copper in,	177, 178
Staphylococcus Pyogenes Aureus,	8	Complications of,	196-236
, Albus,	8	Corrosive Sublimate in,	183-185
St. Mark's Hospital Operation,	229	Course of,	25, 26, 172-175
Streptococcus Pyogenes,	8	Cure of,	172-175
Strasburg Civil Hospital,	50	Cyanide of Mercury,	186
Styes,	76	Definition of term,	101-103
Sulphate of Copper (<i>see</i> Bluestone),	177, 209	<i>De Novo</i> Origin of,	23
, Zinc Points,	190	Duration of,	171, 172
Sunlight,	71	Escharotic Treatment	
Sutton School,	3, 78, 79	, of,	164-192
Symblepharon,	23	Excision of Cul-de-sac	
, Posterius,	174, 236	, in,	143, 147-156
Syndectomy,	136, 209	" Expression " in,	144, 156-164
Synovitis in Purulent Ophthalmia,	24	Frequency of,	111-113
Tannic Acid,	134, 188	Frottage in,	184, 185
Tents for Ophthalmia Cases,	61	General Health in,	193, 194
Tincture of Iodine in Trachoma,	186	Influenced by Insanitary	
Tobin's Tubes,	71	, Surroundings,	26
Towels,	41, 42, 257-259	, " Iodid-hydarg " in,	185, 186
, Plans of suspending,	257-259	Iodine in,	186
Toxic Conjunctivitis,	242, 243	Iodoform in,	186
Trachoma, Acute,	4, 13-15, 191	Idol in,	186
, Ancient Treatment of,	126, 127	<i>Lapis Divinus</i> in,	178, 179
, Alummol in,	188	Lead in,	188, 189
, Alum Points in,	190	Lotions in,	192, 193
, and Abscess, Meibomian Glands,	212	Lunar Caustic in,	179-183
, " Affections Tear Passages,	220, 221	Organisms of,	19
, Blepharitis,	212-216	Pannus in,	196-211
, Corneal Complications,	196-211	Perchloride Crayon in,	185
, Dermatitis,	211, 212	Psorosperms in,	23
, Ectropion,	236	Quinine in,	186, 187
, Entropion,	221-235	Sal Alembroth in,	185
		Silver in,	179-183
		Sketch of,	126-147
		Sporozoa in,	23
		Stages of,	176
		Sulphate of Zinc in,	190
		Surgical Treatment of,	147-164
		Tannic Acid in,	188

PAGE	PAGE		
Trachoma, Tincture of Iodine in,	186	Vulvar Discharges and Measles,	80
" Tobacco in,	142	" " " Ophthalmia,	
" Ulcerative Keratitis in, 196-211		" " " 42, 49, 50, 69, 70	
Transmission of Ophthalmia,	27-57	" " Frequency in Children, 49	
Trichiasis,	23, 103, 221-235	Washing Arrangements and Ophthalmia,	
" Causes of,	222-224	" " " 2, 39-48, 72, 73, 244-259	
" Depilatory Treatment of,	224	Water and Spread of Ophthalmia,	
" Palliative Treatment of,	224	" " " 42-48, 244-259	
" Signs of,	222	" Supply,	72
" Surgical Treatment of,	225-235	Watson's Operation,	230, 231
Tylosis,	213	Xystrum, the,	126
Ulceration of Cornea,	13, 103, 196-211	Yellow Lotion,	192, 193
Urine, Contagion passed by,	36, 37	Zerophthalmos,	236
Vasani's Experiment,	42	Zerosis, Epithelial,	77
Ventilation, Importance of,	71		
Vesiculo-grain, Meaning of Term,	99		

INDEX OF AUTHORS.

PAGE	PAGE
Abadie, 52, 139, 141, 143	Carter, Brdenell, 39, 85, 86
Adamniuk, 88, 89	Castro, Silva, 140
Adams, A. Leith, 45, 46	Cecchini, 144
Adams, Percy T., 112	Celsus, 126
Adams, Sir William, 55, 129, 130	Chandler, George, 36, 137
Adler, 4, 143, 144	Chassaignac, 12
Ægineta, Paulus, 126, 224	Chauzeix, 140
Aguilar Blanch, 143	Cheatham, 143
Albini, 136	Chevallereau, 184
Alcon, 142	Chisholm, 190
Alt, Adolf, 67, 143, 201	Christovitch, 187
Ammon, Von, 174, 234	Clarke, Ernest, 215
Anagnostakis, 53	Collins, E. Treacher, 190
Anfuso, 143	Cooinch, 51
Arlt, von, 1, 12, 28, 29, 36, 39, 49, 227, 228	Coppez, 141
Assalini, Paolo, 128	Costomiris, 143, 187
Astruc, 36, 136	Coursserant, 141
Bacot, 49	Critchett, Anderson, 12
Badal, 142	Critchett, George, 137
Bader, 51, 138, 139	Cuénod, 215
Bassereau, 124	Cunier, 37, 43, 49
Beaumont, W. M., 112, 143, 187	Cullerier, 43
Bell, Benjamin, 124	Czermak, 152
Benedikt, 49	
Bendz, 58	Dastot, 61
Benson, Arthur H., 112, 140, 229	Darier, 138, 143, 144
Berlin, 212	Davis, 69
Bernard, Aimé, 142	De Beck, 188
Berry, George A., 39, 53, 112	Decondé, 30, 31, 33, 51, 82
Berthelot, 139	Dehenne, 144
Bessinger, 38	Delagénière, 143
Blubaugh, 144	Delpach, 41
Brachet, 143, 148	Demetriadès, 54
Brailey, W. A., 141	Deneffe, 140
Bridges, J. H., 39, 72, 168	Derby, 141
Brière, 54, 139	De Schweinitz, 39, 94
Bronner, Adolph, 12, 112	Desmarres, 134
Borelli, 135	Desormais, 138
Boucher, 51	Despagnet, 148
Boucheron, 141	De Wecker, 39, 88, 139, 140, 141, 144
Bountah, 53	Dianoux, 137
Bowman, Sir Wm., 139	Dismissas, 143
Buyx, 137	Dixon, James, 37
Cadéi, 136	Dor, 141
Canstatt, 82	Doyne, R. W., 112
	Dransart, 142

	PAGE		PAGE
Duddell, Benedict,	126	Guillié, .	35
Dudgeon, .	139	Gunning, .	44
Dujardin, .	140	Gulz, Ignaz, .	134
Durr, .	122	Guthrie, G. I., .	134, 224
Duval, .	224	Guyot, .	134
Eales, Henry, .	112	Hairion, 9, 31, 32, 68, 82, 133, 134, 137, 139, 176	
Eble, .	30, 87, 131	Hall, I. C., .	51
Edmonston, .	8, 51, 128	Hamilton, .	134
Eiselt, .	33	Heisrath, .	143
Eliasberg, .	143	Heister, .	224
Elschnig, .	143	Higgens, Charles, .	94, 139
Fadda, .	135	Hildige, .	139
Fallot, .	133, 139	Hippel, .	141, 184
Falta, .	184	Hippocrates, .	126, 147
Farrell, Charles, .	39, 129	Hirschberg, .	37, 41, 54
Fergus, Freeland, .	112	Hirschmann, .	144
Fernandez, Santos, .	142, 148	Hocken, .	216
Fieuza, .	144	Hogg, .	12
Florio, Pierre, .	1, 61	Holmes, C. R., .	143, 187
Foot, .	36	Hoor, .	29, 65
Foucher, .	140	Hotz, .	144, 148, 156
Fourrey, .		Howe, Lucien, .	53, 141
Fox, Webster, .	52	Hulme, .	12
Frank, Philip, .	84, 122	Humphry, .	139
Franklin, .	130	Hutchinson, Jonathan, .	54
Frolich, .	144	Iwanoff, .	212
Fromont, .	186	Jacob, .	49
Frost, W. Adams, .	39	Jacobsen, .	4, 143, 146
Fuchs, Ernst, 11, 28, 39, 49, 54, 90, 94, 146, 201, 214		Jaeger, Fr., .	138
Furnari, .	137	Jaesche, .	144, 148, 157, 227, 228
Fust, .	141	Johnson, G. Lindsay, .	144, 145
Galezowski, .	87, 141, 143, 147	Juler, Henry, .	12, 39
Galtier, .	180	Jüngken, .	49
Gayet, .	141	Just, .	144
Geddie, D. Watson, .	42	Kartulis, .	20
Germann, .	25	Karwetsky, .	144, 157
Giffo, .	143	Kasauron, .	144
Gibson, Benjamin, .	37	Keining, .	184
Gilbert, .	12	Kerchhove, .	37
Gillet de Grandmont, .	140	Kerst, .	139
Giotti, .	143	Keyser, .	143, 156
Glorieux, .	243	Kraft, .	38
Goldzieher, .	28, 29	Knapp, .	12, 157, 158
Gorecki, .	52	Koch, .	20
Gosselin, .	50	Koltchewski, .	210
Goubé, .	142	Korn, .	144
Gouzée, .	131, 133, 137	Küchler, .	137
Graddy, .	157	Lagrange, F., .	144
Gradle, .	213	Lainati, .	140
Graefe, 4, 12, 27, 139, 142, 193, 218, 134		Lawrence, Sir William, .	36, 39, 41, 51
Gram, .	18	Lawford, J. B., .	193
Green, .	233	Lawson, George, .	94, 139
Greenhow, .	36	Leszynsky, .	70
Griffith, A. H., .	112	Levesque-Lacroix, .	143, 187
Gross, .	39	Lewinski, .	4
Grossman, .	51	Litteljohn, S. G., .	53, 212
Gruening, .	210		

	PAGE		PAGE
Lloret,	148	Pilz,	135, 156
Lloyd,	66	Piringer,	43, 44, 139
Löffler,	82	Pitts, Barton,	144
Lydston,	142	Pollak,	141
Mackenzie, William,	37, 49, 135, 193, 199	Poncet,	139
Macnamara, N. C.,	144	Ponti,	140
Magnus,	4	Pooley,	157
Mandelstamm,	91, 144, 156	Pope,	143
Manfredi,	141	Prince,	157
Manolesca,	143	Pruner,	34
Manz,	12	Quellmalz,	37
Martin,	141		
Marston, A. Jeffrey,	33, 45, 84, 115, 117, 118, 120	Raehlmann,	25, 34, 91, 224
Mason,	12	Reed, Sir William,	126
Masselon,	144	Reiech,	144
Mazza,	140	Richel,	137, 143, 152
M'Donnell, Robert,	136	Richter,	143
M'Gillivray, Angus,	207, 112	Ricord,	124
M'Gregor, Sir P.,	34, 37, 41, 53, 131	Ridgway, T. H.,	132
M'Grigor,	130	Ridley, N. C.,	23
Merge,	143	Risley,	190
Meyer, Édouard,	94, 217	Rivaud-Landrau,	139
Michel,	19	Rodolphi,	136
Millingen, E. van,	134, 228	Rohema,	143, 187
Mittendorf,	55	Roosa,	215
Moauro,	220	Roosbroeck,	134, 136, 139
Moore, Sir Wm.,	53, 54	Rust,	131
Morax,	6, 20, 49	Ruvioli,	138
Morton, A. Stanford,	12, 139	Saemisch,	88, 94, 142
Mouat, J. F.,	39	Samelson,	144
Moura-Brazil,	140	Sans, Pierre,	52
Müller,	30	Sattler,	19, 29, 90, 140, 144, 148
Murchison,	124	Saunders, J. C.,	81, 129, 131, 143, 199
Musa, Antonius,	224	Scarpa,	136
Mutermilch,	91	Schmidt,	19, 49
Neisser,	18	Schmidt-Rimpler,	90
Nelson, Joseph,	112	Schneller,	148
Nesbitt,	46, 47	Schroder,	135
Nettleship, Edward,	12, 40, 86, 87, 94, 103, 189	Scott, Kenneth,	183, 186
Nicati,	141	Sedan,	141, 143
Nicolini,	141	Sehjepkin,	142
Noiszewski,	19, 144	Serres,	137
Noyes, H. D.,	144, 157	Severn, W.,	43
O'Halloran, Thomas,	81, 132	Shortt,	129
Osio,	140	Sichel,	1, 87
Panas, Ph.,	90, 94, 139, 143, 210	Smith, Eugene,	141
Paoli,	135	Smith, Priestley,	112
Parinaud,	52	Snell, Simeon,	61, 112
Parisot,	61	Snellen,	218, 219
Parisotti,	141, 143	Speville,	53
Parokes, E. A.,	46	Spokes, Sidney,	159
Peach,	129	Standish,	144
Peunow,	144	Stilling,	189
Pfälz,	143	Stokes, Wm.,	134
Pfeiffer,	23	Stromeyer,	85
Pignatari,	194	Swanza, H. R.,	39, 94, 112, 156
		Swediaur,	36
		Teillais,	137
		Teodoro,	140

	PAGE		PAGE
Terrier, .	140	Walther, Von,	131, 155
Terson, .	49, 141	Walton, Haynes,	211
Thompson, T., .	112	Wardrop, .	48, 49
Torri, .	139	Ware, James,	8, 39, 48, 136, 192
Tourdes, .	50	„ Lynam,	1
Travers, Benjamin,	41, 131	Warlomont, .	32, 33, 84, 139
Treitel, .	143	Watson, Alexander,	132
Truc, H., .	194	„ Sir Thomas,	31
Turnbull, .	67	„ W. Spencer,	230
Tyrrell, .	8, 41	Webster, .	141, 144
Unterharnscheidt, .	144	Weeks, .	20, 35, 143, 157
Vacher, .	137	Weesemael, Van,	139
Vachez, .	141	Wellbank, .	36
Vallez, .	141	Welch, F. H.,	85, 122
Varlez, .	133	Wells, Soelberg,	39, 139
Vasani, .	42	Werner, Louis,	94
Veszely, .	143	Westhoff, .	157
Vetch, 18, 34, 39, 127, 128, 131, 142, 189		Wickerkiewicz,	141, 144, 188
Vignes, .	143, 187	Widmark, .	8, 12, 41, 49, 215
Vlemincks, .	1, 133	Wilde, Sir William,	9, 156
Vossius, .	140, 143	Windsor, .	139
Vonkchévitch, .	143, 148	Wolfe, .	134
Wadsinsky, .	142, 144	Woolhouse, .	126, 127
Walker, Henry,	138	Wormald, .	216
		Würdeman, .	90
		Zieminski, .	12

LITERATURE.

1 GRAEFE, . . . *Arch. f. Ophth.*, Leipzig, 1854, bd. i., Abth. 1.
 2 JACOBSON, . . . *Ibid.*, bd. iv., Abth. 2.
 3 LEWINSKI, . . . *Ann. d'ocul.*, Bruxelles, tome xlv., p. 43.
 4 MORAX, . . . "Recherches Bactériologique sur l'étiologie des conjonctivites aiguës." Paris, 1894.
 5 ROOSBROECK, . . . *Ann. d'ocul.*, Bruxelles, 1853.
 6 EDMONSTON, . . . "A Treatise on the Varieties and Consequences of Ophthalmia." 1806.
 7 WARE, . . . "Remarks on the Ophthalmia, Psorophthalmia, and Purulent Eyes of New Born Children." Fifth Edition. London, 1814.
 8 TYRRELL, . . . "A Practical Work on the Diseases of the Eye." London, 1840.
 9 WIDMARK, . . . "Bakteriologiska studier öfver den purulenta Konjunktiviten." *Hygiea*, June, 1884; also Sept., 1884.
 10 FUCHS, . . . "Manuel d'ophtalmologie, traduit sur la deuxième édition Allemande par les Docteurs Lacompte et Leplat." Paris, 1892, p. 95.
 11 GIBERT, . . . *Arch. gén. de méd.*, Paris, 1857.
 12 CHASSAIGNAC, . . . *Ann. d'ocul.*, Bruxelles, 1847.
 13 HULME, . . . *Med. Times and Gaz.*, London, 31st October 1863.
 14 NETTLESHIP, . . . *St. Thomas' Hospital Reports*, 1880, vol. x.
 15 CRITCHETT & JULER, . . . *Transactions of the Ophthalmological Society*, vol. iii., p. I.
 16 BRONNER, . . . *Ibid.*, vol. xiii., p. 26.
 17 MORTON, . . . *Ibid.*, p. 29.
 18 KNAPP, . . . *Arch. f. Augenh.*, Wiesb., bd. xii., p. 61.
 19 VON ARLT, . . . "Clinical Studies on Diseases of the Eye," translated by Lyman Ware, M.D. Edinburgh, 1885.
 20 MANZ, . . . *Arch. f. Augenh.* Wiesb., bd. xiv., p. 63.
 21 ZIEMINSKI, . . . *Rec. d'ophth.*, Paris, 1886.
 22 SATTLER, . . . "Ber. d. Ophth. Gesellsch. in Heidelberg," 1881.
 23 MICHEL, . . . *Arch. Ophth. and Otol.*, N. Y., 1886, p. 452.
 24 NOISZEWSKI, . . . *Centralbl. f. prakt. Augenh.*, Leipzig, March, 1891.
 25 KOCH, . . . *Wien. med. Wchnschr.*, 1883.
 26 WEEKS, . . . *Arch. Ophth. and Otol.*, N. Y., 1886, p. 441.
 27 KARTULIS, . . . *Centralbl. f. Bakteriol. u. Parasitenk.*, Jena, 1887.
 28 JULER, . . . *Brit. Med. Journ.*, London, 15th September 1894.
 29 GOLDZIEHER, . . . "Ber. d. ophth. Gesellsch. in Heidelberg," 1881, p. 37, *et seq.*
 30 HOOR, . . . *Internat. klin. Rundschau*, Wien, March 5, 1893.
 31 EBLE, . . . "Ueber den Bau und die krankheiten der Bindehaut des Auges, mit besonderem Bezug auf die contagiose Augenentzündung." Wien, 1828.
 32 DECONDÉ, . . . *Ann. de la Soc. de méd. d'Anvers*, 1837-1838.
 33 WATSON, . . . "Lectures on the Principles and Practice of Physic." Third Edition, 1848, p. 295, vol. ii.
 34 HAIRION, . . . *Ann. d'ocul.*, Bruxelles, 1859.

35 WARLOMONT, "De l'ophthalmie militaire en Belgique." Contained in Warlomont and Testelin's translation of Mackenzie's Treatise. Paris, 1856.

36 PRUNER, *Ann. d'ocul.*, Bruxelles, 1859, p. 241.

37 RAEHLMANN, "Ueber Trachom." Leipzig, 1885.

38 GUILLIÉ, "Bibliothèq. Ophtal." vol. i., p. 91. 1820.

39 VAN MILLINGEN, "A tri-annual Report of Eye Diseases at Constantinople in 1877, 1878, and 1879."

40 CHANDLER, "A Treatise on Diseases of the Eye." 1780, p. 140.

41 FRICK, "Treatise on the Diseases of the Eye." London, 1826, p. 52.

42 LAWRENCE, "Treatise on the Venereal Diseases of the Eye." London, 1830.

43 DIXON, "Diseases of the Eye." London, 1866, p. 59.

44 MACKENZIE, "Practical Treatise on the Diseases of the Eye." Fourth Edition. London, 1854.

45 FUCHS, "The Causes and Prevention of Blindness." Translated by Dudgeon. London, 1885.

46 GIBSON, *Edin. Med. and Surg. Journ.*, 1807, No. x., p. 159.

47 MACGREGOR, "Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge." London, 1812.

48 BESSINGER, *Baier Aerztl. Intelligenzblatt*, No. xvii., 1855.

49 WARE, "Remarks on the Purulent Ophthalmia that has lately been Epidemic in this country." London, 1808.

50 MOUAT, "Ophthalmia in Metropolitan Pauper Schools." Appendix to Third Annual Report of the Local Government Board, 1873-74.

51 BRIDGES, "Ophthalmia in Metropolitan Pauper Schools." *Ibid.*

52 NETTLESHIP, "Report on Ophthalmia in the Metropolitan Pauper Schools." Appendix to Fourth Annual Report of the Local Government Board, 1874-75.

53 DELPECH, "Chirurgie Clinique," vol. i., p. 318.

54 TRAVERS, "Synopsis of the Diseases of the Eye." London, 1820.

55 VASANI, "Storia dell'ottal. contag. dell'ospedale mil. d'Ancona." Verona, 1816.

56 ROOSBROECK, "Traite Theoretique et Pratique des Maladies des Yeux." Gand, 1853.

57 CULLERIER, "Leçons Cliniques sur les Affections blennorrhagiques." Paris, 1861, p. 165. (Redigées et publiées par le Docteur Eugène Royet.)

58 PIRINGER, "Die Blennorrh. am Menschenange." Graz, 1840.

59 GUNNING, "Ber. d. ophth. Gesellsch. in Heidelberg," 1885.

60 MARSTON, *Beale's Archives of Medicine*, vol. iii., 1862.

61 ADAMS, "Army Medical Reports." 1869.

62 BACOT, "Treatise on Syphilis." London, 1829, p. 132.

63 JUNGKEN, *Ann. d'ocul.*, Bruxelles, 1859, p. 355.

64 TERSON, *Arch. d'opht.*, Paris, tome xii., 1892, p. 634, et seq.

65 TOURDES, *Ann. d'ocul.*, Bruxelles, 1852, p. 193.

66 COOINCH, *Arch. f. Augenh.*, Wiesb., bd. xii.

67 GROSSMANN, *Ophth. Rev.*, London, vol. i., 1882, p. 143.

68 BOUCHER, *Rec. d'opht.*, Paris, 1889, p. 348.

69 GORECKI, *Ibid.*

70 FOX, *Am. Journ. Ophth.*, vol. ii., p. 108, et seq.

71 HOWE, *Ibid.*, vol. v., p. 278.

72 BOUNTAH, *Rec. d'opht.*, Paris, No. i., 1881.

73 ANAGNOSTAKIS, "Congrès d'ophthalmologie," 1857 and 1863.

74 LITTELJOHN, "Report on Ophthalmia." (Central London School District.) London, 1888.

75 BERRY, *Trans. Ophth. Soc.*, vol. xiii., pp. 218, 219.

76 MOORE, *Medical Magazine*, July 1893.

77 HUTCHINSON, *Trans. Ophth. Soc.*, vol. xiv., p. 40.

78 BRIÈRE, *Ann. d'ocul.*, Bruxelles, tome lxxviii., 1877, p. 40.

79 MITTENDORF, "Granular Lids and Contagious Diseases of the Eye." Detroit, 1886.

80 MASON, *Ophth. Hosp. Rep.*, London, 1871.

81 HOGG, *Lancet*, London, March 1, 1873.

82 ADLER, *Wien. Med. Wochenschr.*, 1875 and 1878.

83 DASTOT, "De l'ophthalmie Granuleuse dans les Écoles." Mons and Brussels, 1878.

84 SNELL, *Brit. Med. Journ.*, London, 17th November 1894.

85 TURNBULL, *Arch. Ophth. and Otol.*, N. Y., vol. xiii., 1884.

86 ALT, *Amer. Journ. Ophth.*, February 1886.

87 BRIDGES, "Report on Health of Metropolitan Pauper Schools for Seven Years, 1883-1889." London, 1890.

88 SOURDILLE, *Arch. d'ophth.*, Paris, Dec. 1893, and Jan. 1894.

89 BOURGEOIS & GAUBE, *Union méd.*, Paris, No. i., 1894.

90 MAGNUS, "De Diphtheritidis Conjunctivae Epidemia Regiomonti Aestate Anni," MDCCCLXXX. Observata. Thesis, published 1859.

91 HAIRION, *Ann. d'ocul.*, Bruxelles, 1846, p. 159.

92 WILDE, *Lond. Journ. Med.*, vol. iii., 1851.

93 HOOR, "Prophylaxe und Beseitigung des Trachoms," 1893.

94 LLOYD, "A Treatise on Scrophula," &c., London, 1821, p. 321, *et seq.*

95 FOOT, "A complete Treatise on the Nature, Symptoms, and Cure of Lues Venerea." London, 1820.

96 VETCH, "A Practical Treatise on the Diseases of the Eye." London, 1820.

97 EDMONSTON, "Account of Ophthalmia in the 2nd Regiment of Argylshire Fencibles." London, 1802.

98 GREENHOW, "Reports to Privy Council," 1858, p. 209, *et seq.*

99 SAUNDERS, "A Treatise on some practical points relating to Disease of the Eye." London, 1811.

100 O'HALLORAN, "Practical remarks on Acute and Chronic Ophthalmia." London, 1824.

101 CANSTATT, *Bull. Acad. roy. de méd. de Belg.*, Bruxelles. September 1834.

102 DECONDE, *Arch. Belge de méd. militaire*, tome iii., p. 145, 1849.

103 WARLOMONT, "De l'ophthalmie militaire en Belgique." Paris, 1856.

104 FRANK, "Army Medical Reports." 1860.

105 WELCH, *Ibid.*, 1863.

106 CARTER, *St. George's Hospital Reports.* 1873.

107 NETTLESHIP, *British and Foreign Medico-Chirurgical Review.* Oct. 1874, and Jan. 1875.

108 GALEZOWSKI, *Rec. d'ophth.*, Paris, 1874, p. 132.

109 SICHEL (FILS), *Arch. gén. de méd.*, Paris, 1874, tome ii.

110 SAEMISCH, "Graefe und Saemisch, Handbuch der gesammten Augenheilkunde," 1874-77, iv.

111 DE WECKER, "Wecker et Landolt: Traité complet d'ophthalmologie," tome i., Paris, 1880.

112 ADAMIUK, "Wistnik Ophthalmologii." 1889, '90, and '92.

113 WÜRDEMAN, *Amer. Journ. Ophth.*, December 1890.

114 SCHMIDT-RIMPLER, *Rec. d'ophth.*, Paris, 1890, p. 47.

115 RAEHLMANN, *Knappa Archives*, vols. xv. and xx.

116 MANDELSTAMM, *Arch. f. Ophth.*, Leipzig, bd. xxix., i., p. 55.

117 MUTERMILCH, *Ann. d'ocul.*, Bruxelles, Jan. 1893.

118 ADAMS, Sir WILLIAM, "A letter to the Right Honourable and Honourable Directors of Greenwich Hospital, containing an exposure of the measures resorted to by the Medical Officers of the London Eye Infirmary, for the purpose of retarding the adoption and execution of Plans for the extermination of Egyptian Ophthalmia from the Army and from the Kingdom." London, 1817.

119 JACOB, "De la conjonctivite d'origine leucorrhéique." Thèse de Paris, 1879.

120 CRISTOFF, *Rec. d'ophth.*, Paris, 1892, p. 414.

121 MANNHARDT, *Arch. f. Ophth.*, Leipzig, 1868, bd. xiv., Abth. 3.

122 *Ann. d'ocul.*, Bruxelles, tome xlvi., p. 229.

123 REED, "A Short but exact Account of all the Diseases incident to the Eyes," chap. xx. London, 1706.

124 BAAS, "History of Medicine." Translated by H. E. Henderson, A.M., M.D. New York, 1889.

125 ASSALINI, "Observations on the Ophthalmia of Egypt." Translated from the French by Neale. London, 1804.

126 EDMONTON, "A Treatise on the Varieties and Consequences of Ophthalmia." 1806.

127 PEACH, *Edin. Med. Journ.*, 1807, p. 397.

128 SAUNDERS, "A Treatise on some practical points relating to Diseases of the Eye." London, 1811.

129 FARRELL, "Observations on Ophthalmia." London, 1811.

130 "Official Papers relating to Operations performed by order of the Directors of the Royal Hospital for Seamen at Greenwich on several of the Pensioners belonging thereto," &c. London, 1814.

131 "Report submitted to His Royal Highness the Commander-in-Chief upon the subject of the Out-pensioners of Chelsea Hospital," &c., 1819, p. 5.

132 VETCH, "Observations relative to the treatment by Sir William Adams of the Ophthalmic Cases of the Army." London, 1818.

133 "Report of the Committee of Medical Directors of the London Infirmary for Curing Diseases of the Eye." London, 1815.

134 RIDGWAY, *Lond. Med. and Phys. Journ.*, 1825, vol. iii.

135 WATSON, "A Compendium of the Diseases of the Human Eye," p. 53. London, 1828.

136 "Report from the Ophthalmia Committee presented to the House of Commons on the subject of the establishment of the Ophthalmic Hospital, Regent's Park, and on Sir William Adams' claim upon the public." London, 1821.

137 PARISOT, *Gaz. d. hôp.*, Paris, 1874, p. 211.

138 GOSSELIN, *Arch. gén. de médec.*, Paris, Avril, 1869.

139 DAVIS, *The Medical Times* (Philadelphia), 1st Sept., 1871.

140 HULKE, *Trans. Ophth. Soc.*, vol. vii., p. 21.

141 HAIRION, *Ann. d'ocul.*, Bruxelles, 1851 and 1852.

142 HAMILTON, *Practitioner*, June 1869.

143 GUYOT, *Bull. gén. de thérap.*, &c., Paris, 1867, p. 209.

144 GRAFE, *Arch. f. Ophth.*, Leipzig, bd. i., 1854.

145 SATTLER, "Die Trachombehandlung einst und jetzt." Berlin, 1891.

146 BORELLI, *Gior. d'opt. italiano*, 1859, vol. ii., p. 59. Also, the Half-yearly Abstract of the Medical Sciences, 1859, p. 109.

147 FADDA, *Ibid.*, 1870.

148 STOKES, *Dublin Journ. Med. Sc.* Feb. 1866.

149 ALBINI, *Ann. d'ocul.*, Bruxelles, tome lxv., 1871.

150 RODOLPHI, *Gior. d'opt. italiano*, 1870.

151 CADÉJ, *Ann. di ottalmologia*, 1871.

151 FURNARI, *Gaz. méd. de Paris*, 1862. Nos. 4, 6, 8, 10, 12, and 14.

152 CRITCHETT, *Trans. Ophth. Soc.*, vol. i., p. 9.

153 VACHER, *Soc. Fr. d'oph.*, Paris, 1886, p. 124.

154 SCARPA, "The Principal Diseases of the Eye." Translated by Briggs.

155 BUYS, *Ann. d'ocul.*, Bruxelles, 1840.

156 GOUZÉE, *Ibid.*, 1851, p. 89.

157 HAIRION, *Ann. d'ocul.*, Bruxelles, 1858, tome xxxix., p. 213.

158 SERRES, . . . *Ibid.*, 1866, tome lxvi., p. 78.
 159 DARIER, . . . *Rec. d'ophth.*, Paris, 1886, p. 352.
 160 DESORMAIS, . . . "Thèse de Paris," 1886.
 161 BADER, . . . *Lancet*, London, Oct. 28, 1871.
 162 RUVIOLI, . . . *Ann. di Ottalmologia*, 1875.
 163 HILDIGE, . . . *Dublin Journ. Med. Sc.*, Feb. 1869, p. 78.
 164 DE WECKER, . . . *Ann. d'ocul.*, Bruxelles, 1882, tome lxxxviii., p. 24.
 165 MOURA-BRAZIL, . . . *Ibid.*, 1882.
 166 DE WECKER, . . . *Ibid.*, 1882, tome lxxxviii., p. 211.
 167 BENSON, . . . *Trans. Ophth. Soc.*, vol. iv., p. 19.
 168 GRAEFE, . . . *Arch. f. Ophth.*, Leipzig, 1860, bd. vi., ii., p. 133.
 169 BERNARD, . . . "Du traitement du trachome par le jequirity et la Cantharidine," p. 74, *et seq.* Toulouse, 1893.
 170 SANTOS FERNANDEZ, . . . *Arch. Ophth. and Otol.*, N. Y., vols. xx. and xxi.
 171 ALCON, . . . "El Genio Médic.-Guirurgico," March 1883.
 172 LYDSTON, . . . *Ophth. Rev.*, London, vol. xii., p. 243.
 173 CHEATHAM, . . . *Amer. Journ. Ophth.*, May-June 1888.
 174 COSTOMIRIS, . . . *Bull. Acad. de méd.* Paris, Sept. 10, 1889.
 175 HEISRATH, . . . *Berl. klin. Wochenschr.* July 10, 17, and 24, 1882.
 176 POPE, . . . *Arch. Ophth. and Otol.*, N. Y., vol. i., p. 68.
 177 MACNAMARA, . . . "Westminster Hospital Reports," 1890.
 178 LAGRANGE, . . . *Rec. d'ophth.*, Paris, 1892, p. 647.
 179 NOISZEWSKI, . . . *Centralbl. f. prakt. Augenh.*, Leipzig, 1890, pp. 36 and 234.
 180 DARIER, . . . *Rec. d'ophth.*, Paris, 1890, p. 708.
 181 JOHNSON, . . . *Arch. Ophth. and Otol.*, N. Y., vols. xix. and xx. (1890 and 1891).
 182 FUCHS, . . . "Lehrbuch der Augenheilk..," 3rd edition, 1892.
 183 JACOBSEN, . . . "Beiträge zur Path. des Auges," 1888.
 184 BRACHET, . . . *Rec. d'ophth.*, Paris, Feb. 1882, p. 71, *et seq.*
 185 DESPAGNET, . . . *Ibid.*, 1884, p. 491.
 186 VOUKCHÉVITCH, . . . "Etude sur le traitement de l'ophthalmie granuleuse par l'excision du cul-de-sac conjonctival." Paris, 1884.
 187 SCHNELLER, . . . *Arch. f. Ophth.*, Leipzig, 1884 and 1887.
 188 HOTZ, . . . *Ibid.*, bd. xv., p. 147, *et seq.*
 189 JAESCHE, . . . *Ibid.*, bd. xxi., No. 1 (1892), p. 121.
 190 LLORET, . . . *Ibid.*, bd. xx., p. 582.
 191 SWANZY, . . . "Handbook of Diseases of the Eye," p. 94, 3rd edition, 1890.
 192 MANDELSTAMM, . . . *Arch. f. Ophth.*, Leipzig, No. 1, 1883.
 193 KEYSER, . . . *Amer. Journ. Ophth.*, vol. iii., 1886, p. 231.
 194 NOYES, . . . "A Text-Book on Diseases of the Eye," 1890, New York.
 195 PRINCE, . . . *Ophth. Rev.*, London, vol. vii., p. 375. *New York Med. Journ.*, Aug. 3, 1889.
 196 KNAPP, . . . *Arch. Ophth. and Otol.*, N. Y., vol. xxi., p. 121.
 197 LESZYNKY, . . . *New York Med. Journ.*, March 27, 1886.
 198 HALL, . . . "On the Nature and Treatment of some of the more Important Diseases, Medical and Surgical, including the principal Diseases of the Eye," p. 52. London, 1844. Second Edition.
 199 POOLEY, . . . *New York Med. Journ.*, 13th February 1892.
 200 JÜNGKEN, . . . "Ueber die Augenkrankheit welche in der Belgischen Armee herrscht," &c. &c. Berlin, 1834.
 201 GALTIER, . . . *Ann. d'ocul.*, Bruxelles, tome cvii., p. 429, 1892.
 202 SCOTT, . . . *Trans. Ophth. Soc.*, vol. xi., 1891, p. 39, *et seq.*
 203 KEINING, H. AND O., . . . *Deutsche med. Wochenschr.*, Leipzig, No. 41, 1890.
 204 HIPPEN, . . . "Ber. d. oph. Gesel." Heidelberg, 1892, p. 91, *et seq.*
 205 CHEVALLEREAU, . . . *Rec. d'ophth.*, Paris, 1891, p. 483.
 206 FALTA, . . . *Centralbl. f. prakt. Augenh.*, Leipzig, Oct., 1890, p. 309. Also *Pest. Med.-Chir. Presse*, 1893, p. 969, *et seq.*
 207 STEPHENSON, . . . *Lancet*, London, 12th September 1891.

208 FROMONT, . . . *Ann. d'ocul.*, Bruxelles, tome xix., p. 251.
 209 BEAUMONT, . . . *Lancet*, London, 18th October 1890.
 210 STEPHENSON, . . . *Ibid.*, March, 1891.
 211 WICHERKIEWICZ, . . . *Klin. Monatsbl. Augenh.*, Stuttgart, December, 1886.
 212 DE BECK, . . . "Acetate of Lead in Ocular Therapeutics." 1884.
 213 STILLING, . . . *Rev. gén. d'opht.*, Paris, tome ix., 1890, pp. 145 and 241.
 214 COLLINS, T., . . . *Ophth. Hosp. Rep.*, London, Jan. 1887.
 215 LAWFORD, . . . *Trans. Ophth. Soc.*, vol. xiv., p. 238.
 216 JAEGER, . . .
 217 PIRINGER, . . . "Die Blennorrh. am Menschenange." Graz, 1840.
 218 ASTRUC, . . . "A Treatise of the Venereal Diseases," in Six Books. Written originally in Latin by John Astruc, and now translated into English by William Barrowby, M.B. London, 1737.
 219 COPPEZ, . . . "Soc. des Sciences médicale et naturelles de Bruxelles," 20th October 1894.
 220 WEEKS, . . . *Journ. American Med. Assoc.*, 3rd September 1892.
 221 DEMETRIADES, . . . *Ann. d'ocul.*, Bruxelles, Janvier, 1894.
 222 ASTRUC, . . . "A Treatise of Venereal Diseases," in Nine Books. London, 1754.
 223 CUNIER, . . . *Ann. d'ocul.*, Bruxelles, tome xvi., 1846.
 224 M'GILLIVRAY, . . . "Trans. Eighth International Ophthalmological Congress," 1894, p. 281, *et seq.*
 225 GRUENING, . . . "Amer. Ophth. Soc., 17th and 18th July 1889.
 226 CAMBOULIU, . . . "Complications de la conjonctivite granuleuse chronique, et leur traitement." Thèse de Paris, 1883, p. 14.
 227 KOLTCHEWSKI, . . . *Vrach.*, St. Petersburg, No. ix., 1885.
 228 FUCHS, . . . *Arch. f. Ophth.*, Leipzig, bd. xxxi., 2, p. 97.
 229 ROOSA, . . . *Trans. Amer. Ophth. Society*, 1876.
 230 CLARKE, . . . *Brit. Med. Journ.*, London, 15th Sept. 1894; also *Ophth. Rev.*, London, vol. xiii., p. 345.
 231 CUÉNOD, . . . "Bactériologie et parasitologie clinique des paupières." Thèse de Paris, 1894.
 232 HOCKEN, . . . *Rev. gén. d'opht.*, Paris, November 1894, p. 499.
 233 MEYER, . . . "A Complete Condensed Practical Treatise on Ophthalmic Medicine." London, 1844, p. 24.
 234 SNELLEN, . . . "A Practical Treatise on Diseases of the Eye." Translated by Freeland Fergus from the 3rd French Edition, with additions as contained in the 4th German Edition. London, 1887.
 235 GUTHRIE, . . . *Trans. Ophth. Soc.*, vol. x., p. 209.
 236 BENSON, . . . "Lectures on the Operative Surgery of the Eye." London, 1823, p. 16, *et seq.*
 237 WATSON, SPENCER, . . . *Brit. Med. Journ.*, London, 7th February 1891.
 238 GREEN, . . . *Ophth. Hosp. Rep.*, London, 1873.
 239 PANAS, . . . "Transactions of the American Ophthalmological Society," 1880, p. 167, *et seq.*
 240 "Traité des Maladies des Yeux," Paris, 1894, tome ii.
 241 *Lancet*, London.
 242 GLORIEUX, . . . "A Code of Rules for the Prevention of Infectious and Contagious Diseases in Schools," being a Series of Resolutions passed by the Medical Officers of Schools' Association. Third and Revised Edition, London, 1891, p. 25.
 243 FLORIO, . . . *Ann. d'ocul.*, Bruxelles, tome xciv., p. 201.
 244 PARKES, E. A., . . . "Description historique, théorétique, et pratique, de l'ophthalmie Purulente observée de 1835 à 1839 dans l'Hôpital Militaire de Saint Pétersbourg." Paris, 1841, p. 177, *et seq.*
 245 TRUC, . . . "A Manual of Practical Hygiene." Third Edition. London, 1869, p. 496.
 246 *Ann. d'ocul.*, Bruxelles, tome cxi., 1891, p. 81, *et seq.*

246 HIRSCHBERG, . . . *Centralbl. f. prakt. Augenh.*, Leipzig, 1884, p. 213, *et seq.*
 247 ABADIE, . . . *Progrès méd.*, Paris, 26th Jan. 1889.
 248 PARINAUD, . . . *Bull. Soc. d'opht. de Paris*, Févr., 1889.
 249 SANS, PIERRE, . . . "Sur une forme particulière de Conjunctivite Infectieuse semblant se rattacher a un contagé animal." Paris, 1890.
 250 RIDLEY, N. C., . . . *Trans. Ophth. Soc.*, vol. xiv., p. 24, *et seq.*
 251 BRAILEY, W. A., . . . *Guy's Hosp. Rep.*, London, 1883.
 252 PIGNATARI, . . . *Ophth. Rev.*, London, vol. xiii., p. 187.
 253 ALT, ADOLF, . . . "Lectures on the Human Eye in its Normal and Pathological Conditions." New York, 1884, p. 10.
 254 BADER, . . . *Lancet*, London, 1st May 1880.
 255 SPEVILLE, . . . *Ann. d'ocul.*, Bruxelles, September 1893.
 256 FUCHS, . . . *Wien. klin. Wchnschr.*, 1884.
 257 CZERMAK, WILHELM, "Die Augenärztlichen Operationem." Wien, 1893.
 Heft v., p. 283.
 258 DRANSART, . . . *Soc. Fr. d'Ophth.*, 1892, p. 124.

YOUNG J. PENTLAND'S RECENT PUBLICATIONS.

THE ELEMENTS OF OPHTHALMOSCOPIC DIAGNOSIS. FOR

THE USE OF STUDENTS ATTENDING OPHTHALMIC PRACTICE. By GEORGE A. BERRY, M.B., F.R.C.S.Ed., Ophthalmic Surgeon, Edinburgh Royal Infirmary; Lecturer on Ophthalmology, Royal College of Surgeons, Edinburgh. Crown 8vo, cloth, pp. xii., 88. Price 3s. 6d.

TEXT-BOOK of GENERAL BOTANY. By DR. W. J. BEHRENS.

Translation from the Second German Edition. Revised by PATRICK GEDDES, F.R.S.E., Professor of Botany in the University of Dundee. Second Edition, 8vo, cloth, pp. viii., 374, with 408 Illustrations, finely engraved on Wood, and 4 analytical Tables. Price 5s.

DISEASES of the EYE: A PRACTICAL TREATISE FOR STUDENTS OF

OPHTHALMOLOGY. By GEORGE A. BERRY, M.B., F.R.C.S.Ed., Ophthalmic Surgeon, Edinburgh Royal Infirmary; Lecturer on Ophthalmology, Royal College of Surgeons, Edinburgh. Second Edition, thoroughly Revised and Enlarged. 8vo, pp. xvi., 728. Illustrated with Wood Engravings and Coloured Plates from Original Drawings. Price 25s. [Pentland's Medical Series, Volume Second.

DISEASES of the HEART and THORACIC AORTA. By BYROM

BRAMWELL, M.D., F.R.C.P.Ed., Lecturer on the Principles and Practice of Medicine, and on Practical Medicine and Medical Diagnosis, in the Extra-Academical School of Medicine, Edinburgh; Assistant Physician, Edinburgh Royal Infirmary. Large 8vo, cloth, pp. xvi., 783. Illustrated with 226 Wood Engravings, and 68 pages of Lithograph Plates, exhibiting 91 Figures—317 Illustrations in all. Price 25s.

ILLUSTRATIONS of the NERVE TRACTS in the MID and

HIND BRAIN AND THE CRANIAL NERVES ARISING THEREFROM. By ALEX. BRUCE, M.D., F.R.C.P.Ed., Lecturer on Pathology in the School of Medicine; Assistant Physician, Royal Infirmary, Edinburgh. Oblong 4to, cloth, Illustrated with 28 Coloured Plates and Engravings in the text. Price 50s. nett.

DISEASE IN CHILDREN: A MANUAL FOR STUDENTS AND PRACTITIONERS. By JAMES CARMICHAEL, M.D., F.R.C.P.Ed., Physician, Royal Hospital for Sick Children; University Lecturer on Disease in Children, Edinburgh. Crown 8vo, cloth, pp. xvi., 520. Price 10s. 6d.

[Pentland's Students' Manuals.

SUPPURATION and SEPTIC DISEASES. THREE LECTURES

DELIVERED AT THE ROYAL COLLEGE OF SURGEONS OF ENGLAND. By W. WATSON CHEYNE, M.B., F.R.C.S., Hunterian Professor; Surgeon to King's College Hospital; Examiner in Surgery at Edinburgh University. 8vo, cloth, pp. xii., 102, with 4 Illustrations. Price 5s.

GEOGRAPHICAL PATHOLOGY. AN INQUIRY INTO THE GEOGRAPHICAL DISTRIBUTION OF INFECTIVE AND CLIMATIC DISEASES. By AND. DAVIDSON, M.D., F.R.C.P.Ed., late Visiting and Superintending Surgeon, Civil Hospital; Professor of Chemistry, Royal College, Mauritius. In 2 vols., large 8vo, pp. xvi., 1008, Illustrated with Maps and Charts. Price 31s. 6d.

[Pentland's Students' Manuals.

PHYSICAL DIAGNOSIS: A GUIDE TO METHODS OF CLINICAL INVESTIGATION. By G. A. GIBSON, M.D., D.Sc., F.R.C.P.Ed., Assistant Physician to the Royal Infirmary; Lecturer on the Principles and Practice of Medicine in the Edinburgh Medical School; and WILLIAM

RUSSELL, M.D., F.R.C.P.Ed., Assistant Physician to the Royal Infirmary of Edinburgh; Lecturer on Pathology and Morbid Anatomy in the Edinburgh Medical School. Second edition. Crown 8vo, cloth, pp. xvi., 382, with 109 Illustrations, some coloured. Price 10s. 6d.

[Pentland's Students' Manuals.

HYDATID DISEASE in its CLINICAL ASPECTS. By JAMES

GRAHAM, M.A., M.D., late Demonstrator of Anatomy, Sydney University; Medical Superintendent, Prince Alfred Hospital, Sydney. 8vo, pp. xvi., 204, with 84 full page Coloured Plates. Price 16s.

HANDBOOK OF OBSTETRIC NURSING. By F. W. N. HAULTAIN,

M.D., F.R.C.P.Ed., Physician to the Royal Dispensary; late Clinical Assistant to Physician for Diseases of Women, Royal Infirmary, Edinburgh; and J. HAIG FERGUSON, M.D., F.R.C.P.Ed., Physician to the New Town Dispensary; late Resident Physician, Royal Maternity Hospital, Edinburgh. Second edition. Crown 8vo, cloth, pp. xvi., 244, with Coloured Plate and 33 Wood Engravings. Price 5s.

YOUNG J. PENTLAND'S RECENT PUBLICATIONS.

EDINBURGH HOSPITAL REPORTS, IN A SERIES OF CLINICAL PAPERS

AND LECTURES. Edited by a committee representing the various institutions. 8vo, pp. xvi., 650 or thereby, handsomely printed, illustrated with full-page Plates and Engravings. Price per volume 12s. 6d. nett, carriage free. *Volumes First, Second, and Third now ready.*

DISEASES of the STOMACH. By C. A. EWALD, M.D., Extra-ordinary Professor of Medicine at the University of Berlin; Director of the Augusta Hospital. Authorised Translation, with special additions by the Author, by MORRIS MANGES, M.D., Attending Physician, Mount Sinai Hospital, New York. Large 8vo, pp. xvi., 498, with 30 Illustrations. Price 16s.

HUMAN MONSTROSITIES. By BARTON COOKE HIRST, M.D., Professor of Obstetrics in the University of Pennsylvania; and GEORGE A. PIERSOL, M.D., Professor of Embryology and Histology in the University of Pennsylvania. In handsome folio, containing about 150 pages of text, Illustrated with Engravings and 39 full-page Photographic Plates from Nature. In four fasciculi, price 25s. each, carriage free. ** The Edition is limited, and is for sale only by Subscription.

DISEASES of the SKIN. A MANUAL FOR STUDENTS AND PRACTITIONERS. By W. A. JAMIESON, M.D., F.R.C.P.Ed., Extra Physician for Diseases of the Skin, Edinburgh Royal Infirmary; Consulting Physician, Edinburgh City Hospital; Lecturer on Diseases of the Skin, School of Medicine, Edinburgh. Fourth Edition, Revised and Enlarged, 8vo, cloth, gilt top, pp. xvi., 678, with Woodcut and 9 double-page Coloured Illustrations. Price 21s.

[Pentland's Medical Series, Volume First.]

NEW PRONOUNCING DICTIONARY of MEDICAL and SCIENTIFIC TERMS. By JOHN M. KEATING, M.D., LL.D., Fellow of the Royal College of Physicians, Philadelphia; Editor of "Cyclopaedia of the Diseases of Children." Large 8vo, pp. 818. Price 18s.

TEXT-BOOK of ABDOMINAL SURGERY. A CLINICAL MANUAL FOR PRACTITIONERS AND STUDENTS. By SKENE KEITH, F.R.C.S.Ed., assisted by GEORGE E. KEITH, M.B. 8vo, cloth, pp. xvi., 508. Price 16s. *[Pentland's Medical Series, Volume Fourth.]*

THE PARASITES of MAN, AND THE DISEASES WHICH PROCEED FROM THEM. A TEXT-BOOK FOR STUDENTS AND PRACTITIONERS. By RUDOLF LEUCKART, Professor of Zoology and Comparative Anatomy in the University of Leipscic. Translated from the German with the Co-operation of the Author, by WILLIAM E. HOYLE, M.A. (Oxon.), M.R.C.S., F.R.S.E., Curator of the Museums, Owens College, Manchester. Natural History of Parasites in General. Systematic Account of the Parasites Infesting Man. Protozoa—Cestoda. Large 8vo, cloth, pp. xxviii., 772, Illustrated with 404 Engravings. Price 31s. 6d.

DISEASES of the THROAT, NOSE, and EAR. By P. MCBRIDE, M.D., F.R.C.P.Ed., Lecturer on the Diseases of the Ear and Throat, Edinburgh School of Medicine; Aural Surgeon and Laryngologist, Royal Infirmary, Edinburgh; Surgeon, Edinburgh Ear and Throat Dispensary. Second edition, Revised and Enlarged. 8vo, pp. xvi., 682, with Coloured Illustrations from Original Drawings. Price 25s. *[Pentland's Medical Series, Volume Third.]*

FUNCTIONAL and ORGANIC DISEASES of the STOMACH. By SIDNEY MARTIN, M.D., F.R.S., F.R.C.P., Assistant Physician and Assistant Professor of Clinical Medicine at University College Hospital; Assistant Physician to the Hospital for Consumption and Diseases of the Chest, Brompton. 8vo, cloth, pp. xx., 506, Illustrated with numerous Engravings throughout the Text. Price 16s. *[Pentland's Medical Series, Volume Fifth.]*

PRESCRIBING and TREATMENT IN THE DISEASES OF INFANTS AND CHILDREN. By P. E. MUSKETT, L.R.C.P. & S. En., late Surgeon to the Sydney Hospital; formerly Senior Resident Medical Officer, Sydney Hospital. Third Edition, Revised and Enlarged. 18mo., limp roan, for Pocket, pp. xvi., 336. Price 6s. 6d.

LEAD POISONING, IN ITS ACUTE AND CHRONIC FORMS, THE GOULSTONIAN LECTURES DELIVERED IN THE ROYAL COLLEGE OF PHYSICIANS, MARCH 1891. By THOMAS OLIVER, M.D., F.R.C.P., Physician, Royal Infirmary, Newcastle-on-Tyne; Professor of Physiology, University of Durham; Honorary Physician, Newcastle-on-Tyne Dispensary and Industrial Schools. 8vo, pp. xii., 122, with 32 Illustrations, mostly in Colours. Price 10s. 6d.

THE PRINCIPLES and PRACTICE of MEDICINE. By WILLIAM OSLER, M.D., F.R.C.P., Professor of Medicine in the Johns Hopkins University, and Physician-in-Chief to the Johns Hopkins Hospital, Baltimore. Second Edition, thoroughly Revised and largely Re-written, large 8vo, pp. xviii., 1143, with Charts and Illustrations. Price 24s.

THE SCIENCE and ART of OBSTETRICS. By THEOPHILUS PARVIN, M.D., LL.D., Professor of Obstetrics and Diseases of Women and Children in Jefferson Medical College, Philadelphia, and one of the Obstetricians to the Philadelphia Hospital. Third Edition, thoroughly Revised. Large 8vo, cloth, pp. 701, with 269 Wood Engravings, and 2 Coloured Plates. Price 18s.

YOUNG J. PENTLAND'S RECENT PUBLICATIONS.

DISEASES of the MOUTH, THROAT, and NOSE, INCLUDING RHINOSCOPY AND METHODS OF LOCAL TREATMENT. By PHILIP SCHECH, M.D., Lecturer in the University of Munich. Translated by R. H. BLAIKIE, M.D., F.R.S.E., formerly Surgeon, Edinburgh Ear and Throat Dispensary; Late Clinical Assistant, Ear and Throat Department, Royal Infirmary, Edinburgh. 8vo, cloth, pp. xii., 302, with 5 Wood Engravings. Price 9s.

SURGICAL ANATOMY. A MANUAL FOR STUDENTS. By A. MARMADUKE SHEILD, M.B. (Cantab.), F.R.C.S., Senior Assistant Surgeon, Aural Surgeon and Teacher of Operative Surgery, Charing Cross Hospital. Crown 8vo, cloth, pp. xii., 226. Price 6s. (*Pentland's Students' Manuals.*)

MEDICAL GYNECOLOGY: A TREATISE ON THE DISEASES OF WOMEN FROM THE STANDPOINT OF THE PHYSICIAN. By ALEXANDER J. C. SKENE, M.D., Professor of Gynecology in the Long Island College Hospital, Brooklyn, New York. 8vo, cloth, pp. vi., 530, with Illustrations in the text. Price 21s.

ILLUSTRATIONS of ZOOLOGY, INVERTEBRATES AND VERTEBRATES, By WILLIAM RAMSAY SMITH, B.Sc., Formerly Demonstrator of Anatomy, Edinburgh School of Medicine, Minto House; Late Senior Assistant to the Professor of Natural History, University of Edinburgh, and J. STEWART NORWELL, B.Sc. Second edition. Crown 4to, extra cloth, gilt top, with 70 Plates, exhibiting over 400 Figures. Price 7s. 6d.

DISEASES of the DIGESTIVE ORGANS in INFANTS and CHILDREN. WITH CHAPTERS ON THE INVESTIGATION OF DISEASE AND ON THE GENERAL MANAGEMENT OF CHILDREN. By LOUIS STARR, M.D., Late Clinical Professor of Diseases of Children in the Hospital of the University of Pennsylvania; Physician to the Children's Hospital, Philadelphia. Second Edition, post 8vo, cloth, pp. 396, with 12 Illustrations. Price 10s.

OUTLINES of ZOOLOGY. By J. ARTHUR THOMSON, M.A., Lecturer on Zoology and Biology, School of Medicine, Edinburgh. Second edition, Revised and Enlarged. Crown 8vo, cloth, pp. xx., 820, Illustrated with 266 Figures in the text. Price 15s.

(*Pentland's Students' Manuals.*)

CLINICAL TEXT-BOOK of MEDICAL DIAGNOSIS. FOR PHYSICIANS AND STUDENTS. BASED ON THE MOST RECENT METHODS OF EXAMINATION. By OSWALD VIERORDT, M.D., Professor of Medicine at the University of Heidelberg. Translated, with Additions from the Second Enlarged German Edition, with the Author's permission, by FRANCIS H. STUART, M.D., Member of the Medical Society of the County of Kings, New York. Large 8vo, pp. 700, with 178 Fine Engravings, many in Colours. Price 18s.

RESEARCHES in FEMALE PELVIC ANATOMY. By J. CLARENCE WEBSTER, M.D., M.R.C.P.Ed., Assistant to the Professor of Midwifery and Diseases of Women and Children, Edinburgh University. 4to cloth, Illustrated with 26 full-page Coloured Plates from Original Drawings. Price 30s.

TUBO-PERITONEAL ECTOPIC GESTATION. By J. CLARENCE WEBSTER, M.D., M.R.C.P.Ed., Assistant to the Professor of Midwifery and Diseases of Women and Children, Edinburgh University. 4to, cloth, uniform with above, Illustrated with 11 Plates, mostly in Colours, from Original Drawings. Price 16s.

TEXT-BOOK of OBSTETRICS, INCLUDING THE PATHOLOGY AND THERAPEUTICS of the PUPERAL STATE. DESIGNED FOR PRACTITIONERS AND STUDENTS of MEDICINE, By Dr. F. WINCKEL, Professor of Gynaecology and Director of the Royal Hospital for Women; Member of the Supreme Medical Council and of the Faculty of Medicine in the University of Munich. Translated from the German under the supervision of J. CLIFTON EDGAR, A.M., M.D., Adjunct Professor of Obstetrics in the Medical Department of the University of the city of New York. Royal 8vo, cloth, pp. 927, Illustrated with 190 Engravings, mostly original. Price 28s.

THE JOURNAL of PATHOLOGY and BACTERIOLOGY. Edited, with the Collaboration of Distinguished British and Foreign Pathologists, by GERMAN SIMS WOODHEAD, M.D., Director of the Laboratories of the Royal Colleges of Physicians (London) and Surgeons (England). Assisted in Special Departments by C. S. SHERRINGTON, M.D. (Cantab.) (Experimental Pathology); SIDNEY MARTIN, M.D. Lond. (Pathological Chemistry); S. G. SHATTOCK, F.R.C.S. (Morbid Anatomy and Histology); G. E. CARTWRIGHT WOOD, M.D. Edin. (Bacteriology). Issued at quarterly intervals. Subscription One Guinea per annum (in advance), post free.

ATLAS of VENEREAL DISEASES. A SERIES OF ILLUSTRATIONS FROM ORIGINAL PAINTINGS, WITH DESCRIPTIONS OF THE VARIED LESIONS, THEIR DIFFERENTIAL DIAGNOSIS AND TREATMENT. By P. H. MACLAREN, M.D., F.R.C.S.E., Surgeon, Edinburgh Royal Infirmary; formerly Surgeon in charge of the Lock Wards, Edinburgh Royal Infirmary; Examiner in the Royal College of Surgeons, Edinburgh. In one handsome Royal 4to Volume, Extra Cloth. Price 63s. nett.

YOUNG J. PENTLAND'S RECENT PUBLICATIONS.

REGIONAL ANATOMY in its RELATION to MEDICINE and SURGERY. By GEORGE MCLELLAN, M.D., Lecturer on Descriptive and Regional Anatomy at the Pennsylvania School of Anatomy; Professor of Anatomy at the Pennsylvania Academy of the Fine Arts, Philadelphia. In 2 handsome 4to Volumes, of over 350 pages each, illustrated with upwards of 100 full-page Facsimile Chromo-Lithographic Plates, reproduced from Photographs taken by the Author of his own Dissections, expressly designed and prepared for this Work, and coloured by him after Nature. Price per Volume, 42s. nett. ** Detailed Prospectus, with Specimen Plate, post free on application.

CYCLOPÆDIA of the DISEASES of CHILDREN, MEDICAL AND SURGICAL. THE ARTICLES WRITTEN EXPRESSLY FOR THE WORK BY AMERICAN, BRITISH, AND CANADIAN AUTHORS. Edited by JOHN M. KEATING, M.D. In 8 Vols. Royal 8vo, of about 500 pages each, Illustrated with Wood Engravings in the Text, and numerous full-page Plates. Price 12s. 6d. per Volume nett, Carriage Free. * * Detailed Prospectus on application.

SYSTEM of GYNECOLOGY and OBSTETRICS, BY AMERICAN AUTHORS. Edited by MATTHEW D. MANN, A.M., M.D., Professor of Obstetrics and Gynecology in the Medical Department of the University of Buffalo, N.Y., and BARTON COOKE HIRST, M.D., Associate Professor of Obstetrics in the University of Pennsylvania; Obstetrician to the Philadelphia Maternity Hospitals; Gynecologist to the Orthopaedic Hospital. In 8 very handsome Volumes, Royal 8vo, Cloth, of about 400 pages each, fully illustrated with Engravings and Coloured Plates. Price 12s. 6d. each, nett. ** A detailed Prospectus will be sent to any address on application.

A REFERENCE HAND-BOOK of the MEDICAL SCIENCES. EMBRACING THE ENTIRE RANGE OF SCIENTIFIC AND PRACTICAL MEDICINE AND ALLIED SCIENCES BY VARIOUS WRITERS. Edited by ALBERT H. BUCK, M.D., New York City. In 8 very handsome Volumes, Imperial 8vo, Cloth, of about 800 pages each, illustrated with Engravings and Coloured Plates. Price per Volume 25s., Carriage free.

SYSTEM of SURGERY, BY AMERICAN AUTHORS. Edited by FREDERIC S. DENNIS, M.D., Professor of the Principles and Practice of Surgery, Bellevue Hospital Medical College, New York; President of the American Surgical Association, &c. Assisted by JOHN S. BILLINGS, M.D., LL.D., D.C.L., Deputy Surgeon-General, U.S.A. To be completed in 4 Imperial 8vo Volumes, each with Index, containing about 900 pages, and profusely illustrated with figures in Colours and in Black. Volume I. nearly ready. The succeeding Volumes will follow at short intervals. Price per Volume 25s., in cloth binding.

THE NATIONAL MEDICAL DICTIONARY, INCLUDING ENGLISH, FRENCH, GERMAN, ITALIAN, AND LATIN TECHNICAL TERMS USED IN MEDICINE AND THE COLLATERAL SCIENCES, AND A SERIES OF TABLES OF USEFUL DATA. By JOHN S. BILLINGS, A.M., M.D., LL.D., HARV. and EDIN., D.C.L., OXON., Member of the National Academy of Sciences, Surgeon, U.S.A., etc., with the collaboration of W. O. ATWATER, M.D.; FRANK BAKER, M.D.; C. S. MINOT, M.D.; JAMES M. FLINT, M.D.; R. LORINI, M.D.; WASHINGTON MATTHEWS, M.D.; S. M. BURNETT, M.D.; J. H. KIDDER, M.D.; H. C. YARROW, M.D.; WILLIAM LEE, M.D.; W. T. COUNCILMAN, M.D. In two Imperial 8vo Volumes, containing about 1600 pages. Price 50s. nett, carriage free.

A SYSTEM of PRACTICAL THERAPEUTICS: BY VARIOUS AUTHORS. Edited by HOBART AMORY HARE, M.D., Clinical Professor of Diseases of Children, and Demonstrator of Therapeutics in the University of Pennsylvania; Physician to St. Agnes Hospital, Philadelphia. Assisted by WALTER CHRYSTIE, M.D., late Physician to St. Clement's Hospital, and Instructor in Physical Diagnosis in the University of Pennsylvania. 3 Volumes, Royal 8vo, of about 1000 pages each. Uniform with the *Cyclopaedia of Children's Diseases* and *System of Gynecology and Obstetrics*. Price per Volume 22s. 6d., Carriage free. * * Detailed Prospectus free by post on application.

ATLAS of DISEASES of the SKIN. By H. RADCLIFFE CROCKER, M.D., F.R.C.P., Physician for Diseases of the Skin, University College Hospital; Physician to the East London Hospital for Children; Examiner in Medicine at the Apothecaries' Hall, London. To be issued in 16 Fasciculi, price One Guinea each nett, 96 Plates, royal folio size, exhibiting fully 200 Figures printed in Colours, from Original Drawings. *Fasciculi I.—XIII.* now ready.

YOUNG J. PENTLAND,
EDINBURGH: 11 TEVIOT PLACE.
LONDON: 38 WEST SMITHFIELD, E.C.

